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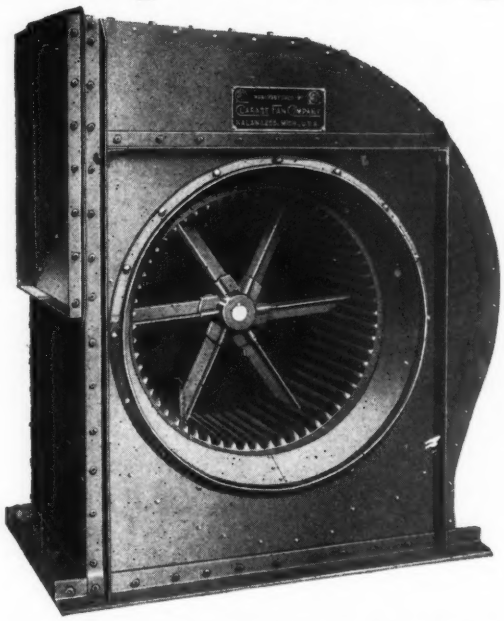

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THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. MARCH, 1918 1123 Broadway, New York

Meeting the High Cost of Heating and Ventilating Apparatus

With Suggestions for Proposed System to Reduce Cost of Installation and Operation.

What can be done to reduce the cost of heating and ventilating installations whose constant and continued advance in price constitutes a real menace to those interested in this line of work? The menace is dangerous and makes itself visible in two quite distinct ways. In the first place the increase in the cost of all building work, both on the material and labor end, tends to make the scrutiny of every item much more close and more critical, creating at the same time a temptation greater than ever before to economize on the equipment of the building in order to allow a greater investment in the structure or its decoration.

The second way in which the menace can be clearly perceived is in the rise of the labor and material cost for heating and ventilating work itself, tending toward the omission of desirable and even necessary ventilation, while the heating end is regarded as a necessary (but expensive) evil.

What, then, can be done to reduce cost without a reduction of service supplied or the loss of permanency in construction? The following suggestions are offered as serving to point the way toward maximum of economy in installations.

PIPE COILS INSTEAD OF RADIATORS.

(*a*) The use of pipe coils in place of radiators wherever possible for the reason that a pipe coil costs less per square foot than a radiator, distributes its heat over a greater area and can be used in almost every position that would accommodate a radiator. While it is true that pipe coils would not look well in a residence or fine office building and are not here advocated for such work, in almost every

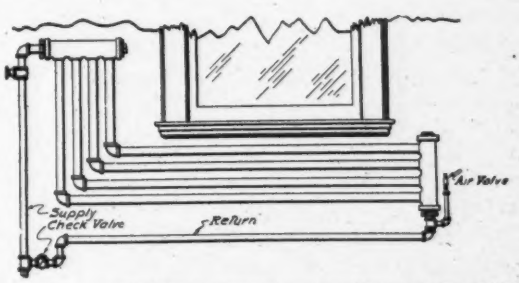


FIG. 1—COMMON TYPE OF MITER COIL FOR ONE-PIPE CONNECTION.

other building they can be substituted with advantage especially if made of the return-bend or miter-coil pattern. There is no logical reason, in these times at any rate, to object to pipe coils in any basement or in schools, garages, halls, auditoriums, industrial buildings, railroad stations, fire houses, police stations, comfort stations, telephone exchanges, etc.

Owing to the efficiency per square foot of a pipe coil being well over 300 B.T.U. while cast-iron radiation runs only 250, or even less, it is possible to reduce the radiation by over 17% where pipe coils are used.

Fig. 1 shows a common type of miter coil installed for one-pipe connection, the coil practically being piped up two-pipe, but with the return connected to the one-pipe riser through the check at the bottom of the drop, the drop above the check being made high enough to furnish the head of water necessary to operate the flap of the check.

AVOID CEILING RADIATION.

(*b*) As the radiation is more efficient when installed at or near the floor, avoid the use of ceiling coils and ceiling radiators. While the placing of radiation on the ceiling will not increase or decrease the mains or boiler load, it will increase the cost of radiation (approximately 10%, or over, additional surface is required for such installation).

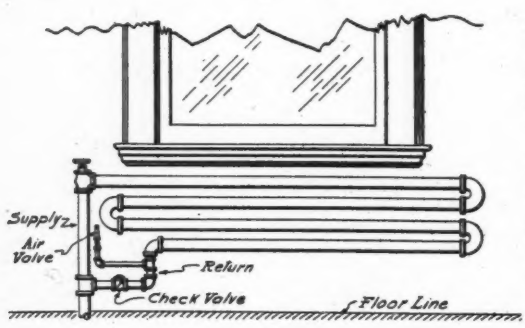


FIG. 2—RETURN-BEND COIL FOR USE IN CRAMPED QUARTERS.

In order to get coils under windows in cramped conditions the vertical end occurring on a miter coil in some cases would extend up in front of the glass. In such cases the return-bend coil, shown in Fig. 2, can be installed, the connections being arranged as shown in Fig. 1. For those objecting to the check valve a water-seal can be substituted, the only object being, of course, to prevent steam entering through the return connection and closing the air valve before the air has been completely expelled.

LARGER UNITS WITH FEWER VALVES.

(*c*) The use of larger units with fewer valves, never using more than two units in any room of ordinary size and valving up larger rooms so that one valve will control as many units as practicable. In this way the number of valves is reduced, a multitude of small runouts and connections are eliminated and much labor can be saved.

(*d*) The elimination, as far as possible, of radiator surface not working at full efficiency, such as recessed radiators, concealed radiators and surface under shelves, or where other hindrances prevent free circulation of air around and across the heating surface.

(*e*) The use of metal sash or wooden sash, with metal weather strips so as to reduce air leakage to a minimum. Also the addition of storm sash or double-glazed windows wherever possible. Under this heading might well be included the use of door checks, double vestibules, revolving doors or other devices to prevent cold drafts when the doors are opened.

(*f*) The omission of covering from the large steam mains in the basement or any other location where the surface of the main can be utilized as heating surface. This will not only

reduce the cost of the covering but will at the same time permit a reduction of radiator surface proportionately.

(*g*) The running of all risers exposed and uncovered (instead of concealed in chases and covered, as is sometimes done) with a corresponding reduction in radiator surface in the rooms through which the risers pass.

USE OF ONE-PIPE IN PLACE OF TWO-PIPE SYSTEMS.

(*h*) The use of the one-pipe steam system either of the "circuit" or "Mills" variety, thereby avoiding duplication of risers, all the return valves on the radiators and much of the return piping.

(*i*) Avoid the use of indirect heating as far as possible, as it is uneconomical to operate and expensive to install. In spite of the fact that an indirect radiator has an efficiency running from 400 to 500 B.T.U. per square foot, the cost of duct work, etc., brings the indirect radiator (per room served) up a higher cost price than the common direct radiator.

Besides this an indirect radiator taking air from outside operates on an average incoming air temperature of 30° F. throughout the heating season, while a direct radiator probably averages 60° or possibly even higher owing to the fact that it does not use outside air.

(*j*) Avoid the use of galvanized-iron as much as possible; black iron painted with asphaltum on both sides will resist rust very nearly as well. Better yet is the substitution of a trunk line consisting of a concrete duct with branches of terra cotta pipe, connecting with vertical tile flues.

FLUES OF MASONRY IN PLACE OF SHEET METAL.

Fig. 3 shows how a heating or ventilating system can be arranged so as to avoid the use of sheet metal from the fan room to the register outlet, provided masonry flues are built from the basement up to the register outlet. Of course, for ordinary systems the vertical flues would be likely to be located on the inner walls rather than on the outside walls as shown. This was so illustrated, however, to explain a later suggestion involving the warm (or tempered) air flues up the outside walls in order to secure certain advantages, as later pointed out.

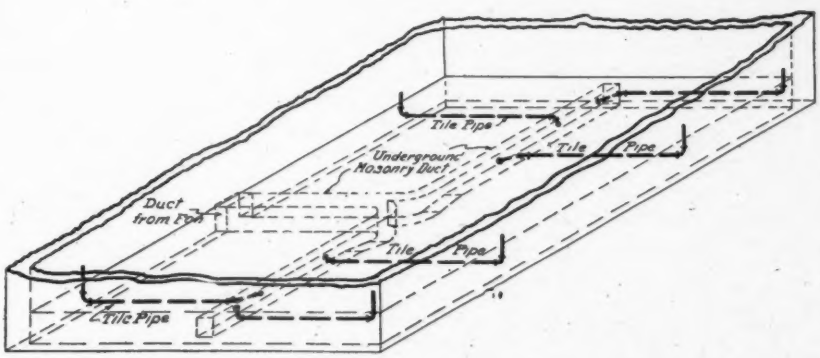


FIG. 3—HEATING SYSTEM ARRANGED TO AVOID USE OF SHEET METAL FROM FAN ROOM TO REGISTER OUTLET.

(*k*) The omission of covering from air flues, especially where the air is for ventilation only and is at or near the room temperature. The loss of heat from large ducts is not as great as might be supposed and if the smaller branches are covered but little drop in temperature will be experienced.

It can be demonstrated by calculat-

ing the heat radiation from a given size of sheet metal duct that the drop in temperature of the air in its passage amounts to but little until the small branches flowing at a low velocity are reached.

HIGHER AIR VELOCITIES IN THE DUCTS, REQUIRING LESS METAL.

(*l*) The use of higher velocities in the ducts, some engineers seldom going over 1,000 to 1,200 f.p.m. velocity even in the largest ducts while others run up to 2,000 f.p.m. or over. The area of the duct in the second case will be about 50% less due, of course, to the increased speed of the air.

In Fig. 4 is shown graphically the quantity of air passed in one minute by two ducts, one 12 in. x 12 in. at 1,000 ft. velocity and the other 0.7 ft. x 0.7 ft. at 2,000 ft. velocity. It can readily be seen that the volumes are identical.

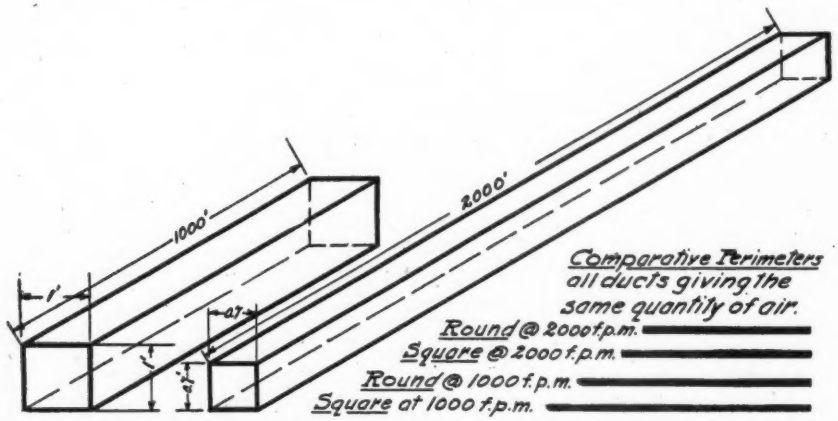


FIG. 4—INCREASES IN AMOUNT OF SHEET METAL REQUIRED FOR DUCTS, DEPENDING ON AIR VELOCITIES AND SHAPES.

But the quantities of metal required are *not* the same. If a round duct at 2,000 ft. velocity has its metal assumed as unity, then a square duct carrying the same amount of air at the same velocity will require 1.13 times as much metal; a round duct at 1,000 velocity 1.38 times as much and a square duct at 1,000 velocity 1.59 times as much. These increases are represented graphically in the lower right-hand corner of Fig. 4.

A PROPOSED HEATING SYSTEM TO REDUCE COST OF INSTALLATION AND OPERATION.

The increasing effort to economize both on the installation cost and the coal consumption leads to the inquiry as to whether a radical change in the method of building ventilation would not do much to remedy the situation.

It is a well-known fact that any radiating surface will increase its heat transmission if a current of air blows across it. This fact has already been recognized in the figuring of indirect heaters whose efficiency is considered anywhere from 400 to 500 B.T.U. per square foot while similar radiation set out in the open in the room is only considered as giving 225 to 250 B.T.U. Also by the fact that a common electric fan set so as to blow against an ordinary radiator will heat the same room much more quickly than by the natural air movement without the fan.

Suppose in buildings where ventilation is provided—particularly in schools—that the fresh incoming air, instead of being put directly into the room, which is the customary procedure to employ, should be made to pass over the room radiators or secondary heaters, becoming heated to any temperature required. Then the room radia-

tion would be working at 60% to 100% increased efficiency, while the air would be entering warm enough to heat the room as well as to ventilate it. On the other hand, if the room at any time should show a tendency to overheating, a cutting off of the secondary heater would result in holding down the temperature by the volume of cooler air coming in.

The advantages of such a system would consist chiefly of the following:

(1) Owing to its lower temperature the air could be efficiently handled in underground or uninsulated ducts and flues.

(2) The flues can be placed on the outside walls in the shape of pilasters, thus economizing on floor space by the omission of the concealing interior wall often called a "breathing wall."

(3) It is possible that the amount of direct radiation in the rooms may be reduced in most cases, owing to its increased efficiency, and certainly the hot blast heater surface may be cut nearly 25%.

(4) Heat is distributed all along the full width of the window sill, the warm air flowing up with a positive velocity (much greater than the natural gravity rise from a radiator) due to the air pressure from the supply fan being behind it.

(5) As a result of this more positive and more distributed upward flow the danger of cold down-drafts under the windows will be greatly lessened or even eliminated.

(6) There should be little or no heat

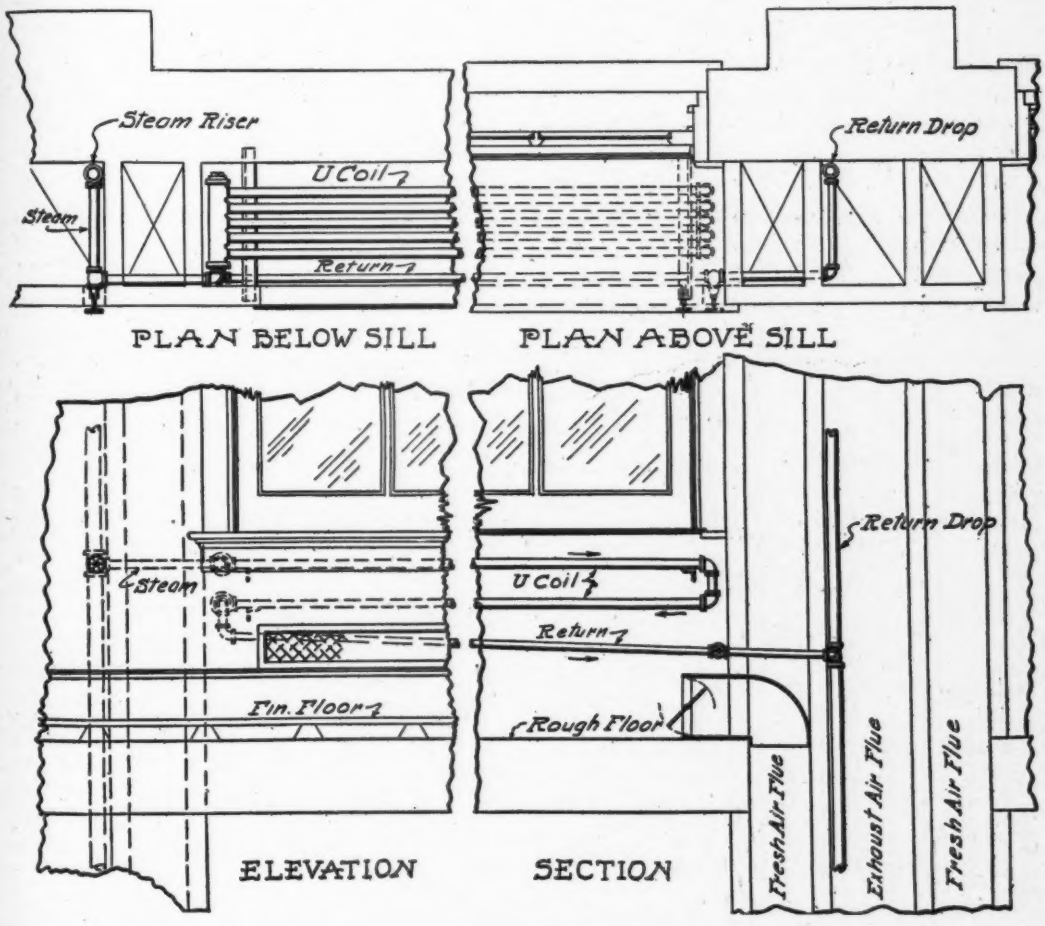


FIG. 5—PROPOSED HEATING SYSTEM WITH PIPE COILS PLACED IN PATH OF AIR SUPPLY.

loss in transmission of air between the fan and the room.

(7) The room can be cooled to any reasonable degree desired even when overcrowded and in mild weather.

DETAILS OF INSTALLATION.

The method of installation of such a system may be assumed as following somewhat along the scheme illustrated in Figs. 5 and 6 where a pipe coil is placed so as to occupy the space under a window seat formed between the fresh and exhaust air flues. For heating when the ventilating system is not in operation the damper in the fresh air flue can be closed and the long register over the base board can be opened so as to maintain a gravity circulation of air in the room.

The ordinary school room has radiator surface running from 40 sq. ft. to 130 sq. ft., according to size, exposure, and amount of glass surface. The amount of fresh air is usually 1,200 c.f.m. for a 40-pupil room and 1,500 c.f.m. for a 50-pupil room. If this air is delivered to the room coils at 60° it must be raised 10° before it can do any heating in the room—assuming the room temperature is to be kept at the usual 70° mark.

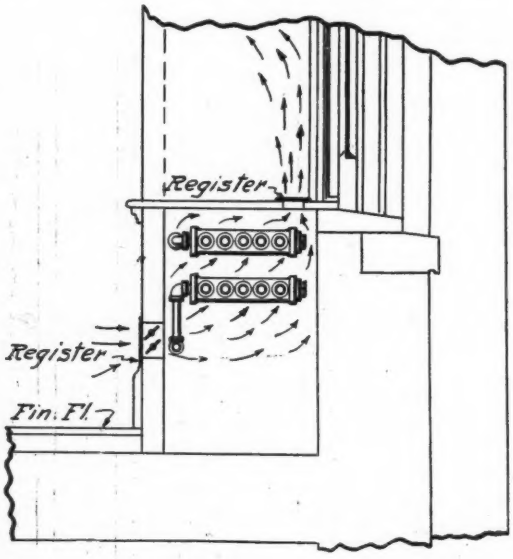


FIG. 6—ARRANGEMENT FOR MAINTAINING AIR CIRCULATION OVER COIL WHEN VENTILATING SYSTEM IS NOT IN OPERATION.

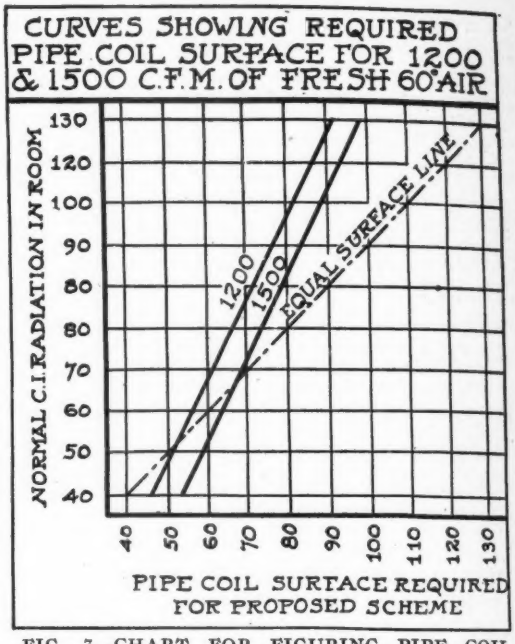


FIG. 7—CHART FOR FIGURING PIPE COIL SURFACE WITH PROPOSED SYSTEM OF HEATING.

Then if the pipe coil efficiency is 500 B.T.U. per square foot it will take $1,200 \times 60 \times 10/55 \times 500 = 26$ sq. ft. of coil surface to heat the air to 70° for the 40-pupil rooms and $1,500 \times 60 \times 10/55 \times 500 = 33$ sq. ft. for the 50-pupil rooms.

If, under ordinary conditions, the room required 40 sq. ft. of cast-iron radiation to heat it, the heat delivery is $40 \times 250 = 10,000$ B.T.U. This amount of heat supplied under the new conditions would require $10,000/500 = 20$ sq. ft. of coil surface. Thus the coil surface for a 40-pupil room with a 40-sq. ft. radiator would be $26 + 20 = 46$ sq. ft. and for a 50-pupil room $33 + 20 = 53$ sq. ft. Similarly for a 40-pupil room if the required C.I. radiator is 130 sq. ft. the heat delivery is $130 \times 250 = 32,500$ B.T.U. and the coil surface $32,500/500 = 65$ sq. ft. to which is added the coil surface for ventilating or $65 + 26 = 91$ sq. ft. of coil for a 40-pupil room and $65 + 33 = 98$ sq. ft. for a 50-pupil room.

These results have been plotted on

the chart shown in Fig. 7. The normal amount of cast-iron radiation is shown in the column at the left while the pipe coil surface is indicated by the scale across the bottom of the chart. The diagonal dot and dash line indicates when the coil surface will equal the cast-iron radiator surface. The heavy solid line marked 1,500 shows the coil surface required (with 1,500 c.f.m.) for any given room radiation while the parallel line marked 1,200 indicates the same for 1,200 c.f.m. It can be seen from this chart that a 1,500 f.p.m. room requiring *over* 52 sq. ft. of cast-iron radiation would need *less* pipe-coil radiation and a 1,200 f.p.m. room *less* if requiring *over* 67 sq. ft. of cast-iron radiation. Of course, conditions may modify the arrangement shown and, in some cases, it may be advisable to use regular indirect cast-iron surface in place of the coils.

It is desired to call attention to the narrow slot used for the admission of the heated air along the window. This is to secure a more equal flow across the face of the window and may be calculated on the basis of 400 ft. velocity out of the slot assuming a slot, say, 3 in. wide. Then for a 1,200-c.f.m. room, the total area of slot would be $1,200/400 = 3$ sq. ft., or $3 \times 144 = 432$ sq. in. The slot, being 3 in. wide, measures 432/3 or 144 lin. in. of slot; $144/12 = 12$ lin. ft. which divided among, say, three windows gives four lineal feet of slot per window. This slot, of course, can be narrowed and lengthened out, or can be widened to supply a larger volume of air.

While practical difficulties may be encountered in trying to work out such a scheme it would seem that it, at least, has enough desirable features to entitle it to serious consideration.

Measurements of Low-Pressure Steam Used for Heating the Buildings of the University of Michigan

By J. E. EMSWILER,

Associate Professor of Mechanical Engineering, University of Michigan.

(*Presented at the annual meeting of The American Society of Heating and Ventilating Engineers, in New York, January 22-24, 1918.*)

In this paper are presented some data relative to the amount of steam required to heat the buildings of the University of Michigan, and the velocity with which the steam is conveyed through some of the pipes, together with a description of the method employed in the measurements.

The experiments, herein described, were undertaken at the request of the Buildings and Grounds Department of the university, to determine the velocity and quantity of steam that is being carried through the low-pressure heating mains fed from the central heating plant. The Buildings and Grounds Department is confronted with the problem of soon extending the central heating system to serve the new Michigan Union Building, as well as that of providing heat for the new and larger library. Some information as to the present load on the heating mains was therefore necessary, and it was in this connection that the experiments were made.

The low-pressure steam furnished for heating is made up in part of the exhaust from the 500 k.w. main generating unit of the plant and its auxiliaries. But the amount of exhaust steam is by far too small in colder weather, and the greater part of the steam used for heating is delivered directly into the

low pressure main through a reducing pressure valve from the high pressure header in the plant. The proportion of exhaust steam and reduced pressure steam of course varies throughout the day with the variation in load on the engine unit, but the average for the winter time is about 25% exhaust and 75% reduced pressure steam.

The entire amount of heating steam is conveyed from the plant through a 20-in. main at pressures varying from 4 to 9 lbs. above atmospheric pressure. At the "substation," Fig. 1, just north

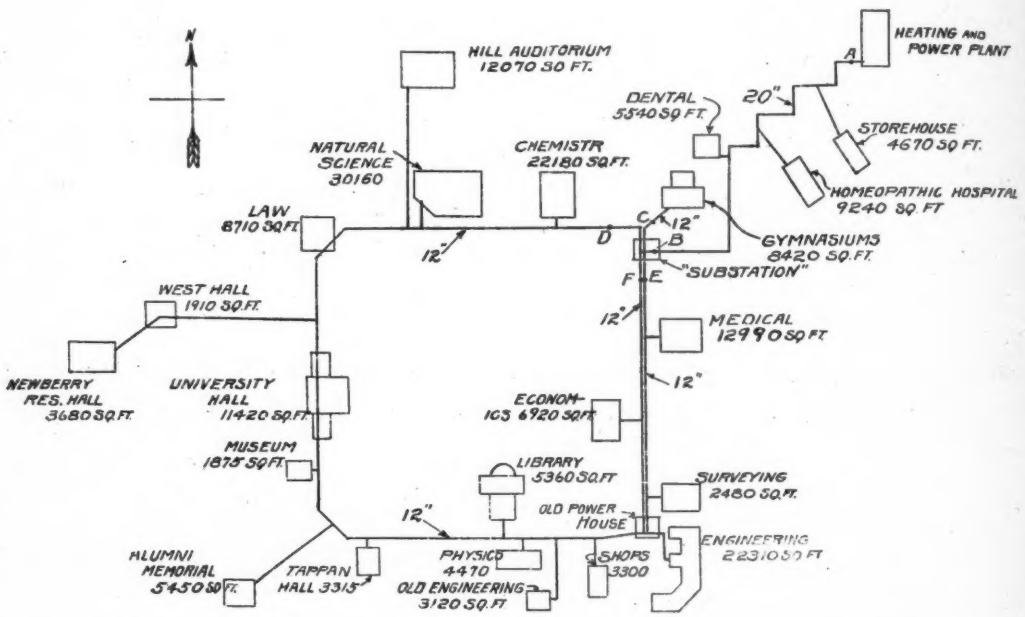


FIG.1—DIAGRAM OF HEATING SYSTEM FOR BUILDINGS OF UNIVERSITY OF MICHIGAN.

of the Medical Building, the 20-in. main divides into four 12-in. pipe branches, of which one serves the gymnasium; one goes to the west, serving the Chemistry Building, Natural Science Building, Hill Auditorium, etc.; the other two go to the south, serving the building on the eastern side of the campus, and after being tied together in the old power house, one line passes to the west, serving the buildings in that direction and finally tying in with the other western branch by a 6-in. line, under University Hall, and so completing the campus loop. The diagram of Fig. 1 will readily explain the arrangement.

The instruments of measurement employed were the Pitot tube and special manometer. The Pitot tube used is of the form shown in Fig 2. The static and total pressure elements are separate, S representing the static and T the total. The tip of the static element, presented to the current, is plugged and the end nicely rounded. There are three 1/16-in. holes on each side of the tip for the communication of static pressure. In addition, there is a row of three holes in the bottom of the tip, to permit any condensation which may have formed in the tube to drain out without obstructing the other openings. The total tube is, of course, open at the end of the tip. Both tubes are made of ¼-in. pipe, nickel plated. The large size was selected in order to obviate any possibility of a drop of water filling the cross-section and interfering with the communication of the true pressure.

The tubes enter the steam pipe through the stuffing boxes B. The total tube is of sufficient length to permit of

a traverse of the pipe. *G* is a guide extending from the tube in the same direction as the tip, and serves to align the tip with the pipe. *V* is a valve for shutting off the steam from the connections, when necessary. *C* is the connection to the manometer. A pressure connection for a gage or mercury manometer can be made to the static tube beyond the valve *R*.

The form of manometer finally devised to register the differential pressure between total and static, that is

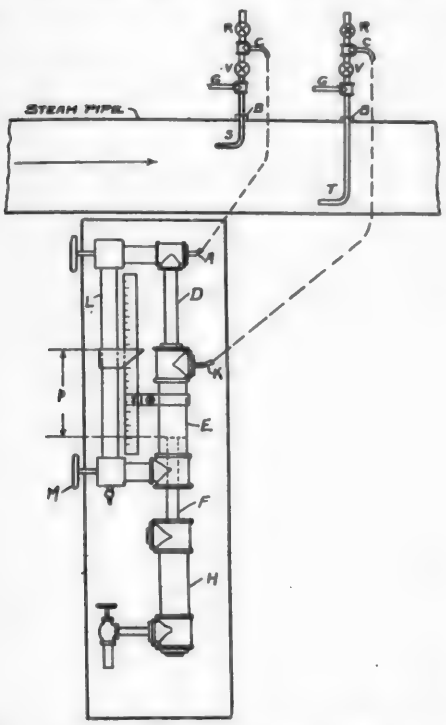


FIG. 2—FORM OF PILTOT TUBE USED IN MAKING STEAM MEASUREMENTS.

the velocity pressure, is also illustrated in Fig 2. The static connection is made at *A*, the pressure being communicated to the ¾-in. gage glass *L*. The total pressure connection is made at *K*. The pressure is exerted upon the water in the 1-in. pipe chamber *E*. The part *D* is not a pipe, but merely a solid connector. The water in *E* stands at the level of the overflow pipe *F*, so that the height of water, *p*, in the glass above a zero reading on the scale corresponding to the top of the overflow pipe in *E* represents the velocity pressure of the steam in inches of water. Condensation in either *E* or *L* cannot accumulate and alter the level in *E*, so long as the overflow chamber *H* is not full.

It will be noted that the entire apparatus is constructed with the idea in mind of taking care of condensation as it is formed, and obviating any errors that might result from its presence. With the same thing in mind, the connecting pipes between the Pitot tube and manometer were relatively large in size, and the greatest care was exercised to see that there were no pockets for the accumulation of condensation. It was at first thought that rubber tubing could be used, but after some preliminary trials, it became apparent that the heat and pressure of the steam was beyond the limits of the rubber. Owing to the necessity of keeping the connecting tubes free of water at all times, the hot steam itself came in contact with the rubber, causing it to rot and ultimately rupture. Flexible metallic gas tubing was then tried but was soon found to develop small leaks. Finally, after the proper position of the total tube in the pipe had been determined by traversing, the connections between tubes and manometer were made of solid ¼-in iron pipe, and after that, no trouble was experienced.

LOCATION OF MEASURING INSTRUMENTS.

Pitot tubes were installed in the 20-in. line, near the substation. This location was known as station B. Similarly, tubes were installed in the several branches to the gymnasium, to the west, and the two to the south, and the stations were designated respectively C. D, E and F in Fig. 1. The combined flow measured at C. D. E and F, should total up to the amount measured at B, and this fact affords a check on the accuracy of measurement.

It was obviously out of the ques-

tion to traverse the pipes at the frequent intervals of reading. The pipes were therefore traversed beforehand and a certain position for the total tube ascertained, at which point the same velocity pressures were indicated as resulted from the average of the ten points on the diameter of traverse. This matter of ascertaining an average position offered much more difficulty than might be expected. The rate of steam flow was subject to frequent and considerable variation, so that in traversing one could not be sure that a difference between readings at different points was due to difference of position of the total tube in the pipe. A plan was finally suggested which made a fairly satisfactory solution possible. The tube was set on a certain point in the traverse, say position 1. A reading was taken on the manometer and instantly the tube was slipped to position 2 and a reading on the manometer again taken. Then, after a few moments, a reading on position 2 was taken and the tube immediately slipped to position 1 and a reading taken there. This was repeated many times, the averages finally furnishing a pretty accurate relation between the velocity pressures at these two points. Then a comparison was made between positions 2 and 3, and so on across the pipe. The position of average reading having been established, the tube was set there and but a single indication was then necessary.

The pressure of the steam was indicated at stations B and D by mercury U-tubes. The temperature of the steam at B was registered by a thermometer in a well in the pipe. It is interesting to note that the steam was superheated at that point, usually to the extent of 40° or 50°.

Observations were begun at 3 p.m. on Thursday, February 1, and were continued for a week, ending Thursday, February 8. Readings at the five stations, B, C, D, E and F, were taken every fifteen minutes. The work was done by students of the Engineering College; the men worked in 8 hour shifts of two men each. Owing to difficulties in getting started and necessary changes in the apparatus, observations taken up to Sunday morning were not considered reliable and are not presented in the curves.

STEAM VELOCITY FORMULA USED.

The velocity of the steam is calculated by the equation $V^2 = 2\,g\,h$, where h refers to the velocity head measured in feet of the substance flowing. The working form of the equation reduces to

$$V = 1096\,\sqrt{p}\,\sqrt{s}$$

where V = velocity in ft. per min.
p = velocity pressure in inches of water.
s = specific volume of steam.

The curves of Fig. 3 show the velocities of the steam in the several pipes, as well as the amount flowing, for the period of time from 7 a.m. Sunday, February 4, to 3 p.m. Thursday, February 8, when the observations were ended. The uppermost curve shows the outside temperature which prevailed at the time.

The velocity curves show that pipe D is much more heavily loaded than any of the others. The maximum velocity indicated is nearly 15,000 ft. per minute. Pipe B (20-in. main) is next, with a maximum velocity indicated of something over 12,000 ft. per minute.

Comparing the curves which show the flow through B (the 20-in. pipe) and the sum of the flows in the four branches, T, it is apparent that, while there is not perfect agreement, by any means, the check is sufficiently satisfactory considering the difficulties.

At night, the valves to all the 12-in. branches except D are usually shut between the hours of 10 or 11 p.m. to 3 or 4 a.m. and the amount of steam falls to a relatively low value.

The demand for steam is greatest during those hours of the day when

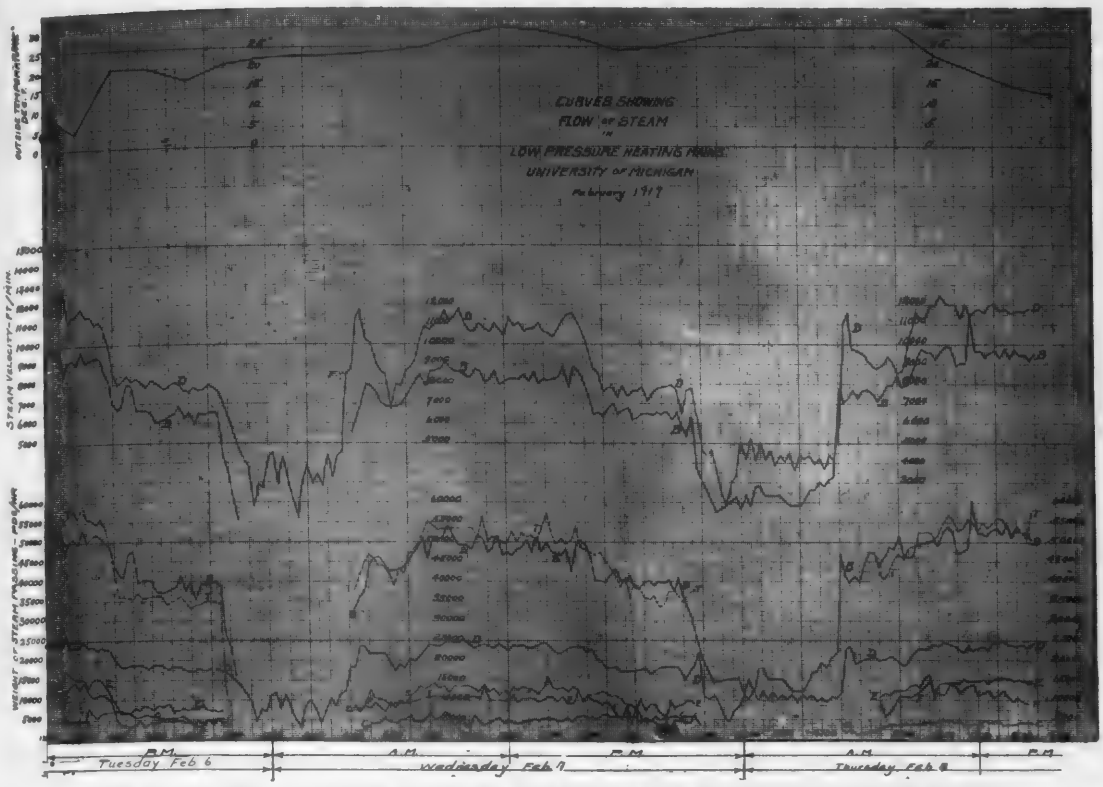


FIG. 3—RECORD OF STEAM FLOW IN UNIVERSITY OF MICHIGAN HEATING MAINS.

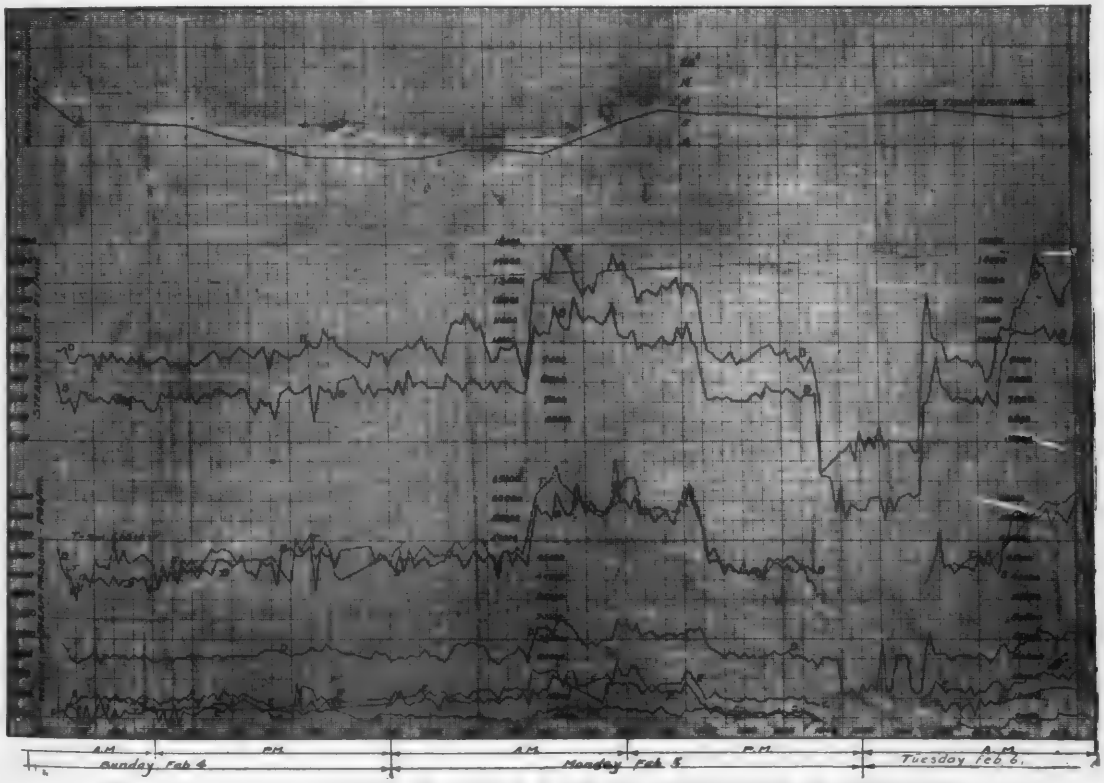


FIG. 3 (continued)—RECORD OF STEAM FLOW IN UNIVERSITY OF MICHIGAN HEATING MAINS.

the ventilating fans are on, that is—from about 8 a.m. until 4 p.m.

The maximum demand for steam was on Monday, which was the coldest day, when a rate of nearly 60,000 lbs. per hour, curve *B* or *T*, Fig. 3, was required for 8 hours. The average demand for steam on that day was about 47,000 lbs. per hour.

The total amount of radiation served by the steam measured is 170,140 sq. ft. and is distributed as shown by the diagram of Fig. 1. The figures above do not represent the entire amount of radiation in the university buildings. It will be noted in the diagram of Fig. 1 that there are three buildings between the heating plant and the "substation" that took off steam which therefore did not reach the place of measurement. Another building of 7,900 sq. ft. of radiation was served by high-pressure steam reduced at the building, and therefore not accounted for in the measurement. And finally the University Hospitals, with a total radiation of several thousand square feet, are heated by an independent plant.

DIFFICULTIES OF TEST.

With the method of measurement employed, some difficulties were encountered which it may be well to point out here.

Not only were there frequent variations in the flow, but there were rhythmic pulsations, due to the discharge of the low-pressure cylinder of the engine into the main. It seems incredible that the engine's discharge could be noticeable in a receiver 20 in. in diameter and nearly a third of a mile long, and yet every stroke of the engine is distinctly visible in its effect on the water level in the manometer, not only at station B in the 20-in. pipe, but in the stations in the branches, though to a lesser extent. These pulsations necessitated the partial closure of the valve *M* (Fig. 3), in order to dampen the fluctuations of the water in the glass and make observation possible. Pulsating flow introduces some error in itself and in this case probably causes another error by allowing some of the water in *E* (Fig. 3) to splash out through the overflow pipe and thus change the zero.

Any leakage in the apparatus or connecting tubes is fatal to accurate readings.

A difference in rate of condensation in the connecting tubes may introduce an appreciable error. This was guarded against as far as possible in the installation of the apparatus, and was further remedied by covering, or partially covering, some of the pipes so as to leave the same length exposed.

More nearly accurate results were undoubtedly obtained at the higher velocities, where the velocity pressure was large. It requires a velocity nearly 5,000 ft. per min., to cause a velocity pressure of 1 in. of water; whereas a velocity of 10,000 ft. per min. will give a reading of 4 in. The maximum velocity observed, about 15,000 ft. per minute caused a deflection of approximately 9 in. in the water level of the manometer.

A station was also established at A, on the 20-in. main, at a point near the heating plant (see diagram of Fig. 1). Only a few observations were made at A, partly because of the lack of men, and partly because of the more violent fluctuations in pressure due to the engine's exhaust.

Such observations as were obtained indicated that there was a loss of pressure from A to B, a distance of about 1,500 ft. of 20-in. pipe, of 3¾ in. of mercury with 57,000 lbs. of steam per hour passing A, and about 6,000 lbs. withdrawn for the buildings connected between A and B.

Also for the same conditions, there appeared to be but 2° or 2½° less superheat at B than at A. Taking into

account both the drop in pressure and the small reduction of superheat, the actual loss of heat per pound of steam, by radiation, is about 2.7 B.T.U.. Assuming 53,000 lbs. per hour as the average rate of steam flow between A and B, the total loss of heat from the 20-in. pipe is 143,000 B.T.U. per hour. The average temperature of the steam within the pipe was about 270°, and that of the air in the tunnel, about 130°, the difference being 140°. The total surface of the 20-in. pipe between A and B is about 7,800 sq. ft. On the basis of these figures, the heat loss is about 0.13 B.T.U. per hour per square foot per degree difference in temperature, which seems rather low, even though the pipe is very well covered. The close proximity of other pipes in the tunnel may have an influence also.

It is evident that this installation furnishes some possibilities for obtaining very valuable information, relating to the friction of steam flowing in pipes, and it is proposed to attempt further investigation of this problem during the next year (1918).

CHICAGO COMMISSION ON VENTILATION

Ventilation Test in an Old Building

The Dante Grammar School, Chicago, Ill.

EDITED BY SAMUEL R. LEWIS

(*Continued from February issue.*)

Dante No. 209

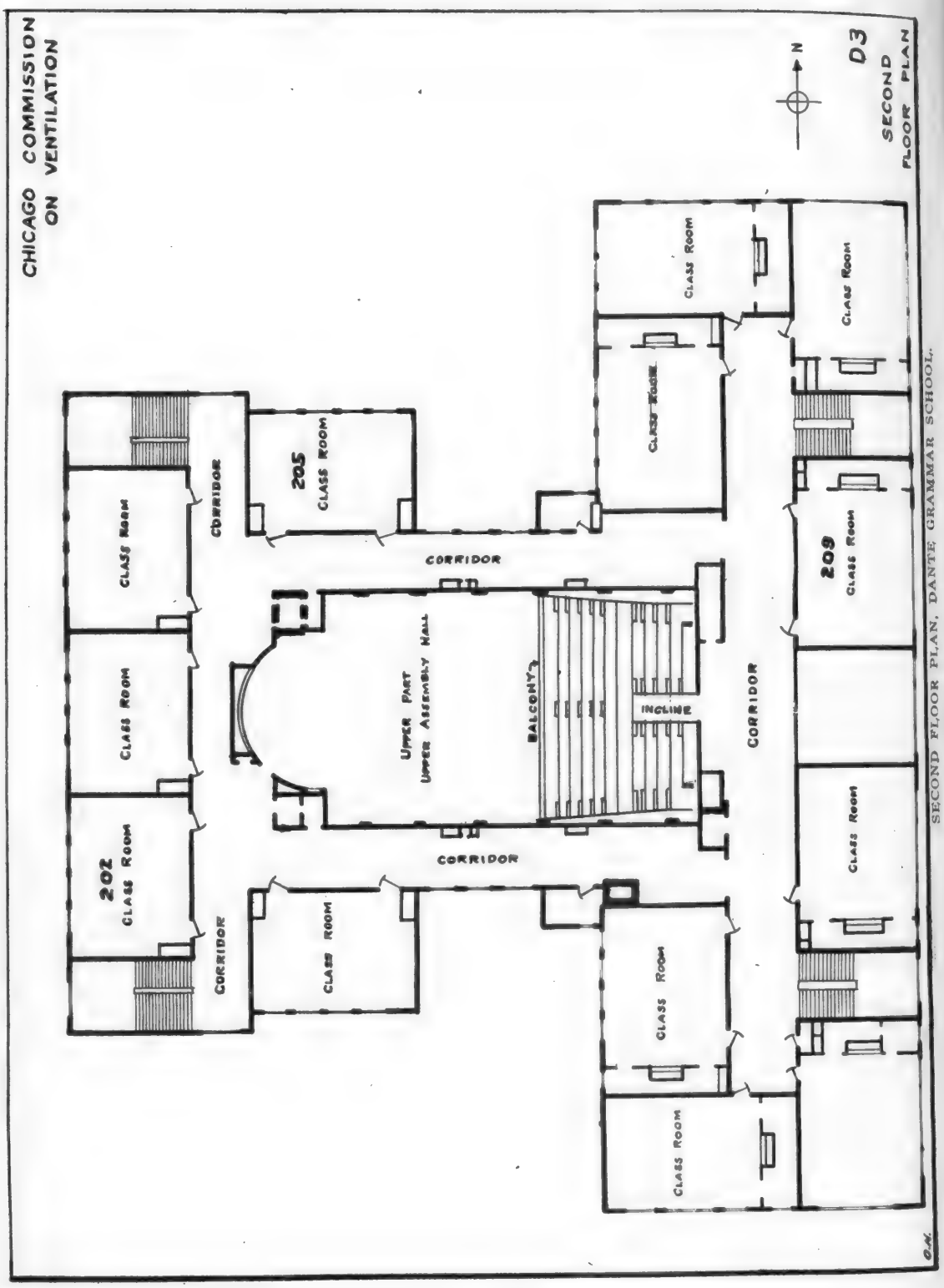
Feb. 15, 1917.

Lewis Champlin No. 104, March 8. These tests may fairly be compared, as both were on the leeward side.

	Cubic Feet Air space per Pupil	C.F.M. per Pupil	Ave. Temp. Deg.F. Dry	Wet	Av. Rel. Humidity Per Cent.	Av. Dust	Av. Bacteria	Av. CO_2	Excess CO_2 over outside
Dante 209	262	31	49	66	26	17200	7	6.9	3.5
Lewis Champlin 104	340	42	53	69	31	40000	5.7	6.7	3.5

The leakage was outward in both rooms, in the Dante being 11% of the supply, and in the Lewis Champlin 20%. In this case the Lewis Champlin pupils were receiving considerably more fresh air than those at the Dante. The supply opening at the Dante was at the center of the room on an interior wall, delivering the air parallel with the glass, and was 96x7¾ in. At the Lewis Champlin the supply opening was on an interior wall, delivering the air toward the glass and was 72x19 in. The CO_2 outside was 3.4 parts for the Dante, and 4 parts for the Lewis Champlin.

The exhaust openings for the Dante are two in number through the doorways into the wardrobe, on each side of the supply, while those at the Lewis Champlin are on the interior wall, alongside the supply. In this comparison we have conditions for Dante 209 very like Lewis Champlin 209, as the air seems to pass around the room, and practically all of the contaminated air leaves through the cloak-room doorway near the outside wall. The CO_2 index shows fairly even results,



SECOND FLOOR PLAN, DANTE GRAMMAR SCHOOL.

and uniform distribution as long as hot air is being introduced. On February 19, however, air at about 70° F. was probably entering, and it appears to have short-circuited to the east outlet, accounting for the high CO_2 at stations 3 and 4. Lewis Champlin 104 is popularly supposed to represent first-class location of supply and exhaust, and the CO_2 results seem to bear this out, though with so large a volume of fresh air per pupil per minute it seems reasonable to expect better ventilation than the tests show, for Lewis Champlin 104.

The automatic humidity controlling apparatus at the Lewis Champlin school showed its superiority over the hand-control of the Dante, as the temperature and humidity at the latter were properly related, while the former was deficient, even for the low temperature.

The Dante school again showed the more favorable condition as to dust, while the Lewis Champlin school showed the lower bacteria count.

There is nothing to be observed in the results from a comparison of these tests to change the conclusions stated for the Dante kindergarten and Lewis Champlin 209. Dante 306 and 311 are similar to Dante 209 in plan, and the results of the tests are reasonably consistent. All are characterized by very considerable outward leakage. As the conditions favor the freshest air always being along the cooling surfaces of the windows, it is this freshest air which leaks out, resulting in deficiency of fresh air, particularly along the interior walls.

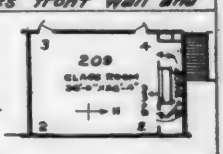
Less dust was usually observed at all tests of the Dante school than was observed at the Lewis Champlin school. It usually increased as the outdoor humidity decreased. The moisture content was almost always out of adjustment with the dry-bulb temperature, and was usually too low

TEST DATA - DANTE GRAMMAR SCHOOL — FEB. 15, 19, 27 - 1917

ROOM 209 :— 2ND GRADE VOLUME = 11800 CU.FT. SUPPLY REG. = 36" × 12" = 3.5 EXHAUST REG. 18½" × 25½" = 3.5 EAST EXPOSURE

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per Cu. Ft.	Bacteria Colonies per Plate	Odors % Fresh Air	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb 15 1:25	44 Pupils 1 Teacher		275	1430	360	1260	1	66	49½	28			8		7.0	27	81	S.W.	12
							2	66½	49	25			11		7.3				
		Fan = 172 R.P.M.					3	66½	49	25			7		6.0	CO_2 outside = 3.4			
							4	66	49½	28			0		7.3				
	45	262	275	1430	360	1260	AVE.	66¼	49½	26½	50	17200	7	30	6.9	Distribution = 93.5%			
Feb 15 1:35	44 Pupils 1 Teacher		240	1250	300	1050	1	71	54	31			14		Lost	35	80	S.W.	14
							2	71	54	31			13		3.0				
		Fan = 167 R.P.M.					3	71	54	31			6		10.3	CO_2 outside = 3.8			
							4	71	54	31			16		15.8				
	45	262	240	1250	300	1050	AVE.	71	54	31	50	21100	12	30	11.7	Distribution = 76.7%			
Feb 27 1:50	43 Pupils 1 Teacher		275	1430	370	1300	1	68	51	26			14		5.8 5.3				
							2	68	51	26			18		7.4 6.4				
		Fan = 178 R.P.M.					3	69	51	26			7		6.6 6.7	CO_2 outside = 3.4			
							4	69	51	26			8		8.1 7.6				
							5					5530							
							6					12000							
							INTAKE					5900			4.0				
	44	268	275	1430	370	1300	AVE.	69	51	26	50	10500	9	30	8.1	Distribution = 96.3%			
	45	262	263	1370	343	1200	TOTAL AVE.	68.7	51.4	27.8	50	16300	9	30	8.6	" = 86.7%			

Air leaves supply registers and rises to ceiling, drops as it reaches front wall and returns thru door in N.E. corner. Practically no air returns thru door in N.W. corner.



D17

TEST DATA FOR ROOM 209.

for comfort; the dry-bulb temperature was too high. The air delivered was always considerably in excess of 30 cu. ft. per occupant per minute, as measured by anemometer, and was always deficient as measured by CO_2 index. These rooms all had long inlets, shallow as to vertical dimensions, and all exhibited the injector effect, drawing up contaminated air with the fresh air jet.

CLASSROOM NO. 105, SHOWING AIR SUPPLY, AT LEFT, AND EXHAUST SPACE UNDER WARDROBE BEHIND BLACKBOARDS.

Dante 105, 304, 202 and 205.

Feb. 15, 19-28, March 1, 1917.

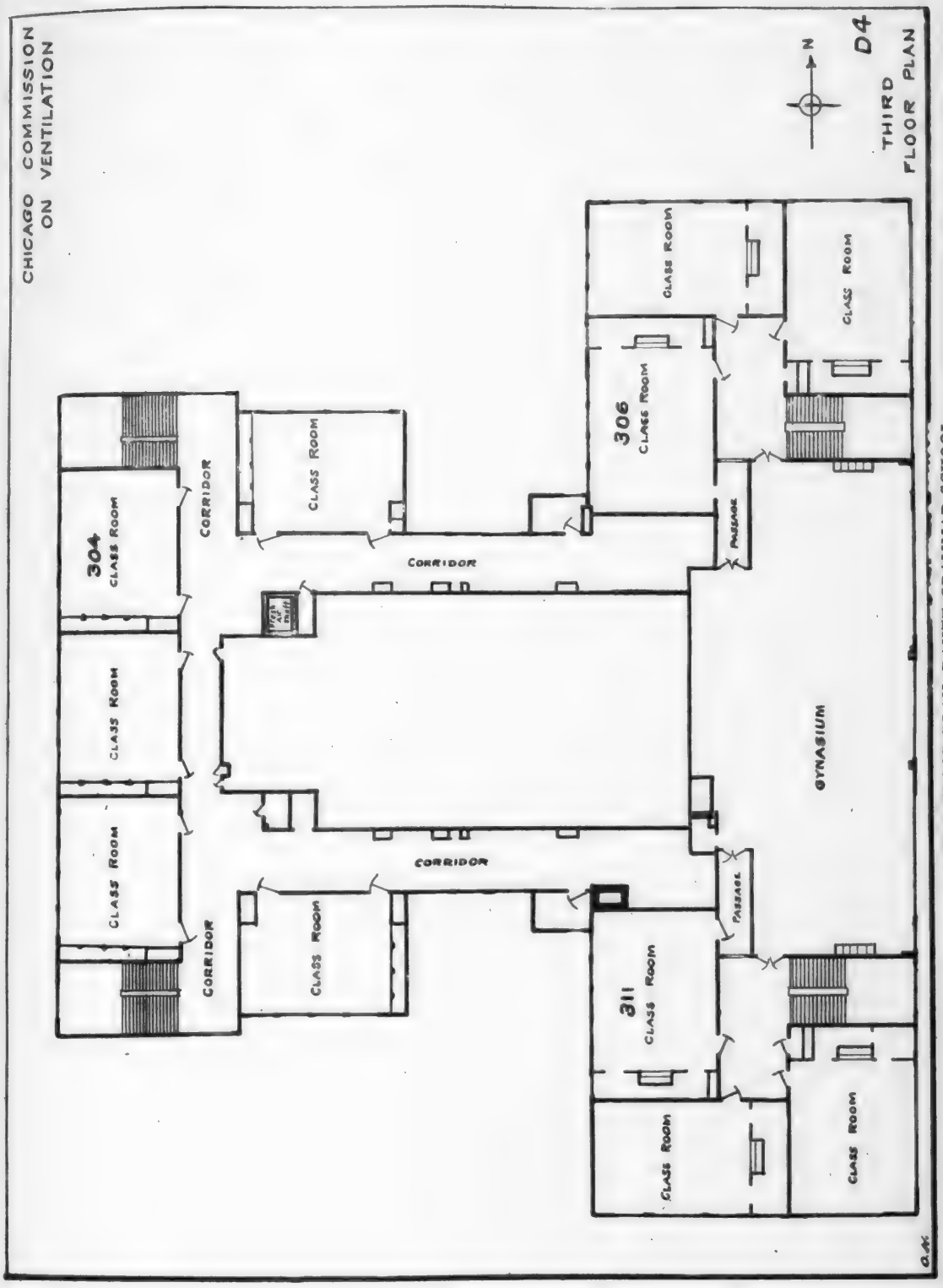
Dante 105, 304, 202 and 205 are similar in plan. In all of them the leakage was outward. In all of them the supply openings were about 72x19 in. and the injector effect was not noticed. The same criticisms as above outlined apply to the humidity adjustment. The tendency was to carry too high a dry-bulb temperature. The results observed are not consistent with those observed in Lewis Champlin 209, the plan of which is similar.

	C.F.M. per Pupil	Percent Leakage out.	Av. CO_2	Excess CO_2 over outside	Cubic Feet Air space per Occupant	Temp. Dry Bulb Deg. F.	CO_2 outside
Lewis Champlin 209	30	25	6.4	2.2	290	70	4.2
Dante 304	40	33	9.7	6.0	257	72	3.7
Dante 202	40	34	10.4	6.7	263	74	3.7
Dante 105	47	43	7.2	3.5	340	73	3.7
Dante 205	47	24	7.3	3.6	295	71	3.7

Rooms 102, 202 and 304, for instance, all have west exposure, and were tested the same days under the same wind conditions. The following may account for the apparent discrepancies, which we will endeavor to locate by further tests:

The thermostats in all of these rooms are set too high. It is possible that warm air was being delivered to Lewis Champlin 209 and Dante 105 and 205 when the CO_2 tests were made, while cool air was entering Dante 202 and 304 when the tests were made. It was noted in 202 that draft was perceptible at the breathing line, while the lack of movement near the windows would be accounted for by a cool air delivery. In room 105, February 28, with dry-bulb 74 the CO_2 showed poor distribution, accountable by a cool air delivery. (The thermostat may have just been caused by the high temperature, to reverse the dampers, and the themometer may not have had time to respond.) This same effect probably accounts for the uneven CO_2 at dry-bulb 74° in 304, Feb. 15. No other plausible explanation occurs to us. The leakage is excessive, but the greatest leakage occurs in 105, the average condition of which is not inconsistent with Lewis Champlin 209. It is obvious that reducing the Dante leakage is advisable.

In testing the Lewis Champlin school rooms 201 and 301, particularly favorable results were observed in rooms similar to the foregoing Dante rooms except that the supply openings were diagonally opposite the outlets. We will compare Dante 205 average, perhaps the best of its type, with Lewis Champlin 201, March 9.



THIRD FLOOR PLAN, DANTE GRAMMAR SCHOOL.

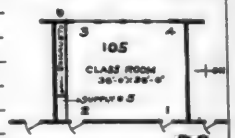
TEST DATA - DANTE GRAMMAR SCHOOL

FEB. 15, 19, 28 - 1917

ROOM 105 1ST GRADE VOLUME = 11800 CU. FT. - SUPPLY REG. = 71" x 19½" = 9.6 ft. EXHAUST REG. = 30" x 16½" = 3.4 ft. WEST EXPOSURE

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per Cu. Ft.	Bacteria per 2 Mem. Plate	Odors % Free from	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb. 15 11:10	45 Pupils 1 Teacher		200	1920	290	990	1	73	52	20½			14		6.0	28	80	S.W.	12
							2	71½	51½	22½			11		6.0				
		Fan = 152 R.P.M.					3	71½	51½	22½			8		6.1	CO_2 Outside = 3.4			
							4	73	52	20½			5		5.4				
	46	256	200	1920	290	990	Ave	72¼	51¾	21½	60	12600	10	90	5.9	Distribution = 96.3%			
Feb. 19 2:50	39 Pupils 1 Teacher		155	1490	200	680	1	73	54	26			12		7.5	35	80	S.W.	14
							2	72½	54	27			24		5.1				
		Fan = 145 R.P.M.					3	72½	54	27			20		6.0	CO_2 Outside = 3.8%			
							4	73	54	26			10		7.0				
	25	470	155	1490	200	680	AVE	72¾	54	26½	50	27500	18	90	6.4	Distribution = 86.7%			
Feb. 28 11:15	39 Pupils 1 Teacher		194	1860	305	1040	1	74	54	24		85000	17		11.9 2.5	27	49	N.	3
							2	74	54	24		"	22		12.8 3.0				
		Fan = 146 R.P.M.					3	73½	53½	23		"	5		11.8 4.4	CO_2 Outside = 4.0			
							4	73½	53½	23		"	6		11.4 6.0				
							5					85000							
							6					100000							
							Intake					28000			3.5				
	40	295	194	1860	305	1040	Ave.	73¾	53¾	23½	50	85000	13	90	8.2	Distribution = 87.5%			
	37	340	183	1760	265	900	Total Ave.	73	53	23½	33	41700	14	90	7.2	"		= 90.1%	

Air motion was such that a slight draft was felt at heads of pupils in East center of room; at front the air rose and turned to west where it dropped to breathing zone and returned to exhaust in south wall.



TEST DATA FOR ROOM 105.

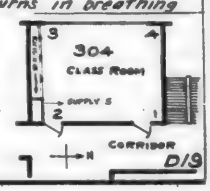
TEST DATA - DANTE GRAMMAR SCHOOL

FEB. 15, 19, 28, 1917

ROOM 304 7TH GRADE VOLUME = 11800 CU. FT. SUPPLY REG. = 72" x 19½" = 9.7 ft. EXHAUST REG. = 30" x 20" = 4.2 ft. WEST EXP.

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per Cu. Ft.	Bacteria per 2 Mem. Plate	Odors % Free from	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb. 16 1:45	44 Pupils 1 Teacher		180	1750	280	1180	1	74½	54	23			2		14.8	27	81	S.W.	16
							2	74½	54	23			2		10.0				
		Fan = 148 R.P.M.					3	74½	54	23			3		11.8	CO_2 Outside = 3.4			
							4	74½	54	23			2		7.7				
	45	262	180	1750	280	1180	AVE.	74½	54	23	50	14700	3	90	11.1	Distribution = 80%			
Feb. 19 11:40	44 Pupils 1 Teacher		205	1980	305	1280	1	72	52	22			12		8.6	29	83	S.W.	14
							2	72	52	22			4		8.7				
		Fan = 150 R.P.M.					3	72	52	22			6		8.1	CO_2 outside = 3.8			
							4	72	52	22			3		6.8				
	44	268	205	1980	305	1280	AVE.	72	52	22	50	22800	6	90	8.0	Distribution = 91.3%			
Feb. 28 2:25	41 Pupils 1 Teacher		190	1840	300	1260	1	72	53	26			4		11.2 10.0	27	49	N	9
							2	72	53	26			3		8.3 3.0				
		Fan = 148 R.P.M.					3	72	53	26			14		9.5 10.8	CO_2 outside = 4.0			
							4	72	53	26			10		14.3				
							5					36000							
							6					42000							
							Intake					28000			19.0				
	43	241	198	1840	300	1260	Ave.	72	53	26	50	38000	8	90	10.0	Distribution = 92.5%			
	46	257	192	1860	295	1240	Total Ave.	72.8	53	24	50	25200	5	90	9.7	"		= 88.1%	

Air rises to ceiling from supply register drops at front of room and returns in breathing zone to exhaust in rear.



TEST DATA FOR ROOM 304.

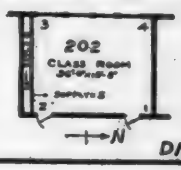
TEST DATA - DANTE GRAMMAR SCHOOL

Feb. 15, 19, 22, 1917

ROOM 202 4TH GRADE VOLUME = 11800 CU.FT. SUPPLY REG. 72" × 19½" = 9.7 EXHAUST REG. = 30" × 20" = 4.2 WEST EXPOSURE

Time	Occupancy	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vel. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vel. C.F.M.	Location	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Fresh Air	CO_2	Weather Conditions Temp.	A.M.	Wind Dir.	Wind Vel.
Feb. 15 11:45	38 Pupils 1 Teacher		190	1850	270	1140	1	77	55	21			8		12.1	28	80	S.W.	12.
							2	77	55	21			16		11.0				
		Fan = 150 R.P.M.					3	77	55	21			8		9.9	CO_2 outside = 3.4			
							4	77	55	21			5		11.5				
	44	270	190	1850	270	1140	AVE.	77	55	21	50	13600	9	90	11.1	Distribution = 93.9%			
Feb. 19 1:30	44 Pupils 1 Teacher		180	1750	280	1180	1	72	56	35			8		13.1	35	80	S.W.	14
							2	72½	56½	35			8		16.0				
		Fan = 148 R.P.M.					3	72½	56½	35			7		9.2	CO_2 outside = 3.8%			
							4	72	56	35			2		8.8				
	44	270	180	1750	280	1180	AVE.	72½	56½	35	50	20200	5.5	85	10.5	Distribution = 72.4%			
Feb. 22 1:45	46 Pupils 1 Teacher		188	1830	290	1220	1	74	53	20			3		10.2 10.4	30	53	N.E.	8
							2	74	53	20			4		8.6 8.6				
		Fan = 150 R.P.M.					3	74	53	20			2		12.7 8.3	CO_2 outside = 4.0			
							4	74	53	20			5		12.2 7.3				
							5					26000							
							6					33500							
							INTAKE					28000							
	47	250	188	1830	290	1220	AVE.	74	53	20	50	37000	3½	90	9.8	Distribution = 83.9%			
	45	263	186	1810	280	1180	TOTAL AVE.	74.4	54.7	25	50	25600	6	88	10.4	"	= 86.7%		

Air in leaving register drops too closely to tops of heads at east end: curls around the front of room and returns on west side in breathing zone. On Feb. 19 there was very little motion near windows to air returning along center of room.



D13

TEST DATA FOR ROOM 202.

TEST DATA - DANTE GRAMMAR SCHOOL

FEB. 15, 19, MCH. 1, 1917

ROOM 205 3RD GRADE VOL. = 11800 CU.FT. SUPPLY REG. = 72" × 19½" = 9.7, EXHAUST REG. = 30" × 20" = 4.2 NORTH EXPOSURE

Time	Occupancy	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vel. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vel. C.F.M.	Location	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Fresh Air	CO_2	Weather Conditions Temp.	A.M.	Wind Dir.	Wind Vel.
Feb. 15 12:00	38 Pupils 1 Teacher		200	1940	360	1510	1	70	50	20			14		6.1	28	80	S.W.	12
							2	70	50	20			28		5.6				
		Fan = 150 R.P.M.					3	69	50	23			27		7.7	CO_2 outside = 3.4			
							4	69	50	23			17		6.2				
	40	295	200	1940	360	1510	AVE.	69½	50	21½	60	15100	22	90	6.4	Distribution = 83.9%			
Feb. 19 1:50	37 Pupils 1 Teacher		210	2040	350	1470	1	70½	54	32			3		7.1	35	80	S.W.	14
							2	70½	54	32			6		10.4				
		Fan = 150 R.P.M.					3	70½	54	32			6		7.4	CO_2 outside = 3.8%			
							4	70½	54	32			4		7.5				
	38	310	210	2040	350	1470	AVE.	70½	54	32	60	19000	5	90	8.1	Distribution = 85.8%			
Mch. 1 11:00	40 Pupils 1 Teacher		180	1750	315	1320	1	73	50	15			2		5.8 4.9	20	58	N	11
							2	73	50	15			5		8.7 7.5				
		Fan = 145 R.P.M.					3	73½	51	17			5		5.8 7.8	CO_2 outside = 4.0			
							4	74	51	16			2		8.0 8.8				
							5					7500							
							6					15000							
							INTAKE					22500			3.8				
	41	288	180	1750	315	1320	AVE.	73.4	50½	16	30	21000	3½	90	7.3	Distribution = 90.1%			
	40	295	191	1910	342	1435	TOTAL AVE.	71.1	51.5	23.2	5.7	18400	10	90	7.3	"	= 85.5%		

Air leaves supply register in S.W. corner and travels rather low to N.E. corner and returns on north side with a tendency toward S.W. corner.

D15

TEST DATA FOR ROOM 205.

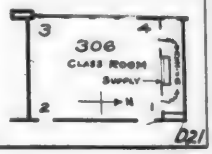
TEST DATA - DANTE GRAMMAR SCHOOL

FEB. 15, 19, 27 - 1917

ROOM 306 6TH. GRADE. VOLUME = 11800 CU. FT. SUPPLY REG. = 36" x 7 3/4" = 5.2 # EXHAUST REG. = 13 1/2" x 25 1/2" = 2.5 # WEST EXPOSURE

Time	Occupants	Air Space per Occupant	Supply Vol. Ft. Per M	Supply Vol. C.F.M.	Exhaust Vol. Ft. Per M	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. Per M	Dust Particles Per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb. 15 2:00	42 Pupils 1 Teacher		350	1820	225	790	1	73½	53½	23			2		9.8	27	81	S.W.	16
							2	74	53	20			1		12.4				
		Fan = 164 R.P.M.					3	74	53	20			3		6.8	CO_2 outside = 3.4			
							4	73½	53½	23			12		9.0				
	43	275	350	1820	225	790	AVE.	73¾	53½	21½	50	11600	4	90	9.5	Distribution = 83.2%			
Feb. 19 1:00	41 Pupils 1 Teacher		440	2290	400	1400	1	71	51	22			16		14.1	29	83	S.E.	21
							2	71	51	22			3		9.4				
		Fan = 174 R.P.M.					3	71	51	22			21		7.8	CO_2 Outside = 3.8			
							4	71	51	22			11		8.4				
	42	280	440	2290	400	1400	AVE.	71	51	22	50	20600	13	90	9.2	Distribution = 88.6%			
Feb. 27 2:30	40 Pupils 1 Teacher		375	1950	400	1400	1	73	53	24			4		7.4 7.5	25	50	N	8
							2	73	52	22			2		7.8 8.6				
		Fan = 172 R.P.M.					3	73	52	22			2		7.4 6.4	CO_2 Outside = 3.4			
							4	73	53	24			2		8.7 8.0				
							5					6000							
							6					12000							
							INTAKE					5000							
	41	290	375	1950	400	1400	AVE.	72½	52½	23	50	10000	3	95	7.9	Distribution = 91.8%			
	42	280	330	2030	340	1200	Temp. AVE.	72.4	52.3	22.2	50	14100	7	92	8.8	" = 87.8%			

Air after leaving supply register travels to ceiling and on striking front wall drops to floor and returns in breathing zone - equal amounts passing thru each door leading to exhaust.



D21

TEST DATA FOR ROOM 306.

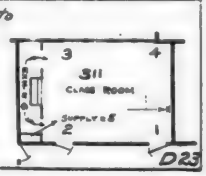
TEST DATA - DANTE GRAMMAR SCHOOL

FEB. 15, 19, 19, MCH 1, 1917

ROOM 311 4TH. GRADE VOLUME = 11800 CU. FT. SUPPLY REG. = 36" x 7 1/2" = 5.2 # EXHAUST REG. = 13 1/2" x 25 1/2" = 3.5 # WEST EXPOSURE

Time	Occupants	Air Space per Occupant	Supply Vol. Ft. Per M	Supply Vol. C.F.M.	Exhaust Vol. Ft. Per M	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. Per M	Dust Particles Per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
Feb. 18 2:15	36 Pupils 1 Teacher		340	1770	400	1400	1	73	54	20½			4		8.0	27	81	S.W.	16
							2	73	52	20½			5		6.2				
		Fan = 172 R.P.M.					3	73	52	20½			1		10.0	CO_2 outside = 3.4			
							4	73	52	20½			5		10.0				
	37	320	340	1770	400	1400	AVE.	73	53	20½	50	14000	4	85	8.6	Distribution = 83.1%			
Feb. 18 11:30	38 Pupils 1 Teacher		360	1820	365	1280	1	72	52	22			7		9.1	29	83	S.E.	21
							2	72	52	22			15		9.6				
		Fan = 172 R.P.M.					3	72	52	22			8		9.0	CO_2 outside = 3.8			
							4	72	52	22			7		9.0				
	39	300	350	1820	365	1280	AVE.	72	52	22	50	24600	9	86	9.2	Distribution = 87.8%			
Mch. 1 11:30	35 Pupils 1 Teacher		240	1250	455	1600	1	72	51	19			8		6.7 7.6	20	58	N	H
							2	70½	50½	21			15		12.0 6.2				
		Fan = 164 R.P.M.					3	71	50½	20			15		11.5 9.0	CO_2 outside = 4.0			
							4	71	50½	20			12		8.8 10.0				
							5					50000							
							6					43000							
							INTAKE					22000			3.8				
	36	320	240	1250	455	1600	AVE.	71	50½	20	40	45000	13	90	9.0	Distribution = 90.0%			
	37	320	310	1610	406	1420	Temp. AVE.	72	51.5	21	47	27900	9	87	8.9	" = 90.3%			

Air after leaving supply traveled straight for front wall where it dropped and returned both sides of room. There was a strong tendency for air in breathing zone to rise and mix with the fresh air and travel forward again.



D23

TEST DATA FOR ROOM 311.

	Cubic Feet Air space Per Pupil	C.F.M. Per Pupil	Av. Deg.F. Dry	Temp. Wet	Av. Rel. Humidity PerCent	Av. Dust	Av. Bacteria	Av. CO_2	Excess CO_2 over outside
Lewis Champlin 201	266	24	73	54	26½	21000	15.2	7.1	2.9
Dante 205	295	47	71	51	23	18400	10	7.3	3.6

Outside CO_2—Lewis Champlain 4.2; Dante 3.7
Leakage out—Lewis Champlin 41%; Dante 24%

Thus, given greater leakage, higher temperature, less air space per occupant, and only 51% of the air per minute per occupant, so much better was the Lewis Champlin arrangement, with its whirling or corkscrew movement of the entire room content, simulating ventilation by displacement, that the CO_2 index was about equal to that at the Dante.

Conclusion:

We believe that from the tests of the various rooms in both buildings the following may fairly be deduced, and while perhaps not conclusive, each should be particularly noted and studied in further tests:

1. The nearer we approach ventilation by displacement rather than ventilation by dilution, the better results we will attain.
   a. High inlet velocities by their injector effect militate against ventilation by displacement.
   b. The best results are attained in the rooms tested where the relation of supply and exhaust is such as to set up a corkscrew form of air travel from supply to exhaust, the supply being preferably on an interior wall, the exhaust preferably nearer the exposure than the supply.
2. All observations prove our agreement that the delivery of a given volume of fresh air into a room does not necessarily constitute ventilation, and from this—
   a. Leakage outward is undesirable, since the air which is thus lost is usually fresh air, reducing correspondingly the fresh air change in the occupied parts of the room.
   b. A large volume of space per occupant is not especially desirable so far as it affects the operation of mechanical ventilation, and with comparatively low ceilings it is easier to create a proper air movement over the bodies of the occupants.
3. Dust and bacteria do not coordinate as far as the tests of the Lewis Champlin and Dante schools indicate.
4. The steam jet humidifiers are capable of furnishing sufficient moisture, but hand regulation of these devices, as at the Dante school, is not satisfactory.
5. The engine-driven fans are highly desirable for ease of regulation and economy of operation, but some means should be provided to insure constant and proper fan speed so as to deliver the required volume of air when the buildings are occupied.
6. In testing ventilating plants in the future, the following should be recorded in addition to the data contained in the above tests:
   a. Temperature of the entering air at the inlet.
   b. Temperature of the air leaving at the outlet.
   c. Weather conditions out-of-doors, especially in their bearing on dust and bacteria.

Thus, if it is raining or snowing, or has recently done so, we may expect less dust in the building, both foot-carried, and air-carried.

Army Hospital Heating

Undoubtedly many of our readers have been watching the progress that is being made in connection with the heating of the various army cantonments and hospitals.

It has been noticed that in some cases stoves have been installed as heaters for this work. Government officials, as well as many heating engineers have gone on record as stating that this type of heating is not suitable for such work, and was only used on account of the unavoidable delay which would have been necessary if an up-to-date steam heating system had been installed in the different camps and hospitals.

As a general proposition, steam heating for this work is much preferable to furnace or stove heating, but in this case the element of time was the deciding factor. Many articles have been written on this subject with practically all of them in favor of steam heating from a central plant, with standard type of cast-iron wall radiation being used in the different buildings. Naturally the piping arrangements would have to be adapted to the local conditions.

It is becoming more evident each day that these cantonments and hospitals cannot be considered as a temporary proposition, but undoubtedly will continue to be used, probably for years longer than was first anticipated; the cantonments as permanent training quarters, and the hospitals to care for those injured during training or in duty overseas. It is, therefore, of great importance that the makeshift system of stove and furnace heating should be replaced as early as possible with an adequate system of steam heating.

Many of the Government officials in Washington have been watching carefully the progress that is being made, and the type of the heating system which is being installed at the Walter Reed Army Hospital, Washington, D. C. If a person who, a few months ago had visited the Walter Reed Hospital, and had occasion to go there since, were to visit that place today he would be somewhat amazed at the sight of the once spacious and beautiful grounds now literally covered with new buildings. His first impression would be that the Hospital had been turned into some kind of industrial or manufacturing establishment, for the many groups of new buildings and the central heating plant with its immense brick chimney more than 150 ft. high, would indicate such to be the case. However, this is not a manufacturing proposition. These buildings have been erected for the sole purpose of housing and treating ill and disabled soldiers.

These buildings, while being considered as temporary, are of standard frame construction. The outside walls are clapboarded, with layers of paper beneath, and the inside walls are arranged with composition wall board, which makes a very neat and attractive structure. When completed there will be a total of at least eighty buildings.

The design and construction of these new buildings was directly under the charge of Col. George F. Downey, Depot Quartermaster at Washington. Nothing has been left undone to make this hospital complete in every respect, and more or less of a permanent nature, not forgetting for a moment to take care of every detail for the most expert and up-to-date treatment of injured soldiers, as well as for their personal comfort, and while every necessary item has been taken care of, yet the total cost of construction and

equipment in this group of hospital buildings is stated to be considerably less than the cost of similar buildings in connection with army cantonment camps.

TYPE OF HEATING USED.

It will be of particular interest to note the type of heating which is being installed in this group of buildings. The steam for the heating of this group of hospital buildings is generated at a central power station, which is equipped with eight 150 H.P. horizontal return tubular boilers, each fitted with Long duplex shaking grates and the necessary auxiliaries such as feed-water heaters, boiler-feed pumps, vacuum pumps, etc.

From this central power station extends an underground tunnel which is 6 ft. wide, 6 ft. high and some 2000 ft. in length. In other words, this tunnel extends from the boiler house to a central point which is used as a distributing center for the different pipe lines to the several buildings. The pipe lines from the tunnel to the separate buildings are run in split tile pipe. A pressure of 100 lbs. per square inch is carried on the boilers. This pressure is to maintain a reserve supply of steam and to operate a large laundry, which is to be erected in the near future, and will be steam driven.

Just before leaving the power house, the steam pressure is reduced to 50 lbs., which pressure is carried on the different heating supply mains to the several buildings. Each separate building has its own reducing valve, the pressure being reduced from 50 lbs. to 1 lb. in the building, which pressure is carried on the radiation. Just before this pressure is reduced in the building, connections are taken off the steam supply for an individual domestic water heater, with which each building is equipped. This heater naturally supplies hot water for bathing, cleaning, etc.

The radiation in the buildings consists of wall radiators placed on the outside walls on brackets, thereby taking up very little space, and leaving the floor free for cleaning.

Condensation from the radiators is returned to the heaters in the boiler house through a separate return main. The condensation from the hot-water heaters in the different buildings is also returned to the boiler house separately, and discharged into the feed-water heaters. It might be well to mention at this time that each of the domestic water heaters in the different buildings is automatically controlled by means of sylphon tank regulators. This naturally means an even and safe temperature of hot water at all times.

It can be seen at a glance that the matter of efficiency and economy of operation has been carefully worked out by the engineers in charge of this work, and no condensation of any nature is wasted, everything being returned to the boiler plant to be used again.

The high-pressure steam mains both in the boiler-house and in the tunnel are covered with 85% magnesia pipe covering, the pipe in the tile conduits with two thicknesses of 1-in. air-cell covering, broken joint method, specially treated to withstand moisture. The exposed piping in the buildings is covered with two thicknesses of 1-in. air-cell covering.

When it was first proposed to erect these buildings, there was much discussion as to the best and most efficient method of heating them. It was finally decided to install the Webster vacuum system, and the contract for this was awarded to the Power Efficiency Corporation, of Buffalo, N. Y., who engineered and designed the heating system, the power plant and the building with its equipment, and whose construction department has built the power plant and installed the different apparatus in connection

with the entire heating system. The foregoing data is furnished through the courtesy of William G. Fraser, general manager of the corporation.

The engineers had in mind the permanency of construction as well as efficiency in operation, and no material of any description has been placed in this work that is not of standard make, and cannot be used again, should these buildings eventually be discontinued.

It can readily be seen that this is not what is termed a "two- or three-year installation," but rather one which will be good for any number of years should occasion require.

It probably will be interesting to know that in addition to the efficiency of the installation, the matter of safety has also been taken care of. All the high-pressure piping in the boiler-house is fitted with Van Stone joints and pipe bends, as far as possible, these being used in preference to fittings. This naturally reduces the number of joints and the possibility of leakage. Also, each boiler is fitted with an automatic stop and check valve, and all feed piping in connection with the boilers is of brass from the boilers to the control valves. There is also installed in the boiler house two vacuum pumps, each having a capacity of 100,000 sq. ft. of radiation, and three brass-fitted boiler-feed pumps, each with a capacity of 500 H. P. There are also two 500 H. P. Webster open-type feed-water heaters, and all water of condensation from different sources passes through either one or both of these heaters before being again pumped into the boilers. Both the vacuum pumps and the boiler-feed pumps are equipped with pump governors. Each boiler is fitted with twin safety valves and also twin blowoff cocks, owing to the nature of the feed water available.

It was necessary to install surface blowoffs on each boiler, also brass piping in connection with the water columns.

Suitable concrete and steel coal vaults have been provided with a storage capacity of at least 4000 tons.

CENTRAL STATION HEATING

Steam Heating in Salt Lake City

BY H. M. FERGUSON

Since the Utah Power and Light Company entered the steam heating field in Salt Lake City, in 1916, some remarkable progress has been made in the development of central station heating in that city. This company took over the plant of the Hotel Utah Company, also known as the Church plant, which took care of the Hotel Utah, the Temple, Tabernacle and a number of other buildings in that vicinity.

A year later, in April, 1917, the company acquired the Newhouse plant which was furnishing heat to a dozen buildings, including the Newhouse Hotel, Boston Building, Newhouse Building and Commercial Club. For some years there has been some central heating carried on from a plant at the rear of the company's West Temple Office Building, this being the boiler plant formerly used by the traction company.

Towards the close of 1917 the company's plans for heating the business district of Salt Lake City took definite shape. It was decided to install a 20-in. main on South Temple Street and from that line run other lines large enough to heat eventually the district bounded on the north by South Temple, on the south by Fourth South and extending east and west from West Temple to State Street. The southern ends of these lines, it is contemplated, will eventually be connected

by a line extending east and west from West Temple to State Street. Provision is also made for a line on Second South Street, extending east and west, for the purpose of tying together the various north and south feeders, for balancing purposes when the distribution system has grown to such proportions as to require such a line.

During the past summer there was installed a 14-in. line connecting the South Temple plant through a tunnel across the Temple grounds to the beginning of the 20-in. main. This feeder will be operated with sufficient initial pressure at the boiler room to deliver 5 lbs. pressure to the distributing system proper, making use of high drop in pressure to obtain sufficient velocity to move through the 14-in. line the required amount of steam. The regulating valve is in the boiler room and is controlled by a small pipe connected with the 20-in. main on South Temple Street. As the pressure fluctuates in the distributing system the pressure in this small pipe actuates this valve and maintains contant distributing pressure.

The same principle is made use of in the 6-in. connection between the West Temple boiler room and the 16-in. line recently installed at the rear of the Kearns Building. It is estimated that from 5 to 50 lbs. pressure will be carried at the plants.

WIDE STREETS A PROBLEM IN ARRANGING FOR SERVICE CONNECTIONS.

In attempting to arrive at the best method of serving the district there were a number of schemes proposed, but all these had to meet the problem of wide streets and large blocks without any regular system of alleys. The ideal district for steam heating, also true with other utilities, calls for a regular system of alleys at the rear of the buildings, making possible short service connections and, in the case of steam heating particularly, an entrance into the building at or near the point where the central system must be connected to the house system.

The width of the Salt Lake streets would make it almost imperative to lay two mains on each street, as near the curbs as possible. The advantage of this construction was appreciated by the city in the laying of its sewer and water mains and also by the electric and gas companies. Consequently we could find no location closer than a point mid-way between the curbs and the car tracks. This would call for the installation of service pipes crossing the construction of the other public services which is particularly difficult on account of the grading of the steam lines for the purpose of handling the water of condensation, making it necessary to locate our mains at an excessive depth in order to get an up-grade from the main to the point of delivery inside the basement.

MAINS LOCATED ON PRIVATE GROUND.

As a result of the above study it was determined to locate mains on private ground as near as possible the rear of the large buildings facing the principal streets.

Our work for this year included a main running through the two blocks on the west side of Main street between South Temple and Second South. This piece of work is completed and operating and leads us to believe that we will be able to continue the same general line of construction until the congested business district is served. This work naturally involves many special conditions such as running through buildings, under basement floors, etc.

COST COMPARES FAVORABLY WITH OPEN STREET WORK.

The cost of this style of construction will compare very favorably with open street work and will have in its favor a very small cost for service connections, both to ourselves and to our customers.

One very pleasant feature of the work during the past summer was the obtaining of right-of-way over private ground, the owners of buildings being very willing to grant us any reasonable privilege in the interest of central heating as against heating from a large number of small boilers which besides increasing dirt, add very materially to fire hazard in the business district.

The type of underground construction used so far consists of wrought-iron pipe for carrying the steam, this surrounded by a wooden envelope from 4 to 5 ins. in thickness. The pipe is first wrapped with asbestos paper securely wired on, and surrounding this is 1-in. dead air space between the wood casing and the pipe. The insulating covering is lined with tin.

Except where very porous gravel was encountered, tile under-drainage was installed. Expansion joints are located about 100 ft. apart, and midway between these joints the line is anchored.

The company is now serving 63 buildings.

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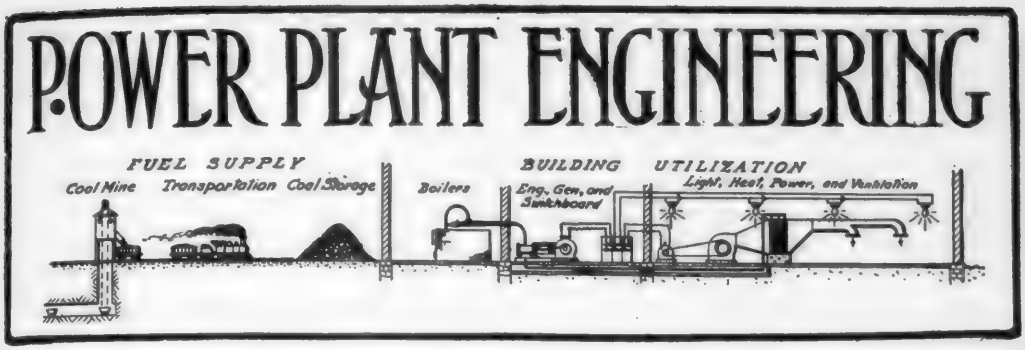
A NEW type of blackmailer is plying his trade among consulting engineers and, while the manufacturers of building equipment pay the freight, their loss is outweighed by the damage done to the professional character of the engineers involved. The scheme, in brief, is as follows: A solicitor singles out a prominent consulting engineer and offers to print for him, free of cost, a booklet describing in a general way, the classes and types of buildings for which he has recently designed the mechanical equipment, and to furnish him with, say, 1,000 copies. Many of these buildings are illustrated, the whole making a very attractive and impressive document. All that the promotor asks in exchange is the privilege of running advertisements in the booklet.

Now for the blackmail. The advertisements, naturally, are to be solicited from the manufacturers whose apparatus has been installed in the buildings illustrated in the booklet, the names of such manufacturers being furnished by the engineer. In some cases the engineer is asked to lend the influence of his name to assist the solicitor. The plan has worked so well for the solicitor that one manufacturer reports having received an average of five letters a week from as many cities, the names of the respective engineers and architects being prominently mentioned. In one case, at least, the proposition was made direct by the engineer himself, who stated, among other things, that "we have decided to carry advertising in amount sufficient to pay for the cost of publication and we are submitting our proposition to those firms only whose product we specify."

Irrespective of the argument that might be made as to whether the advertisers are to receive value for their money, the important point to consider is the moral effect this practice must have on the engineer himself, in lowering his standard of ethics and in its reflection on the profession in general. It is bad business, the character of which has, no doubt, not been realized by most of the engineers involved. Probably it is not necessary to do more than call public attention to the practice to squelch it effectually.

ONE good result of the severity of the past winter is the nation-wide campaign that has been conducted to educate the householder and building manager in the art of managing their heating systems. Hereafter, householders will be more discriminating buyers than formerly, and while it entails an added responsibility on the manufacturer of heating apparatus, it widens very appreciably the field for the sale of high-class heating systems and devices.

POWER PLANT ENGINEERING



Space Requirements for Engines

In laying out a building power plant one of the most vital considerations is that of space. Oftentimes the engine room is an afterthought or a makeshift and the incorporation of the apparatus may be so far controlled by the space conditions as to limit, perhaps, the makes and types of engine permissible to install.

Where an engine room can be laid out to suit the equipment no such limitations exist, but under such conditions space should be allowed to accommodate the units of the greatest dimensions which it is possible to install under the specifications. In either case the overall dimensions are essential in determining the makes and type of apparatus in the first case and the size of room required in the second. It should be noted that it is customary to allow space for one additional unit so as to permit an increase in load in the future, either from the building of a new addition, adding more floors, or by increasing the power-consuming equipment of the building.

For this reason the overall dimensions of a few of the standard makes of machines are presented to give a general idea of the space requirements necessary for a given horsepower, kilowatts and size of engine. It must not be assumed necessarily that all the engines listed herein are instantly available as the war has upset the engine industry most thoroughly. In fact, not only are most units subject to a time of delivery running into many months but others cannot be obtained during the war at all. The return of normal conditions, however, will undoubt-

The American Ball simple engine, referring to Fig. 1, (February issue) has the following dimensions:—

Horse-power	40		60				80		
Kilowatts	25		35				50		
Speed R.P.M.	350 to 400		300 to 325				275 to 300		
Size, inches	8½x8	10x8	9x10	10x10	11x10	12x10	11x11	12x11	13x11
Steam, in. diam.	2½	3	3½	3½	4	4	4	4	4
Exhaust, in. diam.	3½	3½	4	4	4½	4½	4½	4½	5
Length, feet	85¼		101½				109		
Width, feet	81¼		86½				94⅝		
Height, feet	53½		57½				65½		
Weight, lbs.	5050		7250				9200		

(Continued)

Horse-power	120			160			200		
Kilowatts	75			100			125		
Speed R.P.M.	260 to 290			240 to 260			220 to 240		
Size, inches	13x12	14x12	15x12	14x14	15x14	16x14	16x16	17x16	18x16
Steam, in. diam.	4½	4½	5	5	5	6	6	6	6
Exhaust, in. diam.	5	5	6	6	6	7	7	8	8
Length, feet	120			139⅞			149½		
Width, feet	109½			114¾			125¼		
Height, feet	71½			78½			84		
Weight, lbs.	12100			16250			19400		

VILTER CORLISS NON-CONDENSING ENGINES

The Vilter Mfg. Co. builds a simple non-condensing Corliss engine of girder-type, the dimensions, referring to Fig. 2, (February issue) being as follows:

Size In.	RPM	*H.P.	Length	Width	Height	Steam. In. Diam	Exhaust, In. Diam.
9 x 24	100	50	15'-0"	6'-7½"	5'-8"	2½	3
10 x 24	100	61	15'-8"	7'-7"	6'-6"	2½	3
10 x 30	100	77	18'-0"	7'-0"	6'-6"	3	3½
12 x 30	100	110	18'-4"	8'-0"	6'-11"	3½	4
13 x 30	100	130	18'-4"	8'-0¾"	6'-11"	3½	4
14 x 30	100	150	18'-10"	8'-2¼"	7'-5"	4	4½
15 x 30	100	173	19'-0"	8'-9½"	7'-5"	4½	5
16 x 30	100	197	19'-0"	8'-9½"	7'-5"	4½	5
12 x 36	100	133	20'-10"	8'-1½"	7'-5"	3½	4
14 x 36	100	180	20'-10"	8'-9½"	7'-5"	4	4½
15 x 36	100	207	20'-10"	8'-9½"	7'-5"	4½	5

*Horsepower given for 100 lbs. steam pressure and one-third cutoff.

Note:—These dimensions do not include the generator.

BUFFALO HORIZONTAL SIDE CRANK ENGINES

The Buffalo Forge Co. makes the following line of horizontal side-crank engines for high pressure.

H. P.	20	45			65			95		
Kw.	10	20			35			50		
Speed, R. P. M.	450	400			350			300		
Size, In.	6 x 6	6 x 8	8 x 8	10 x 8	8 x 10	10 x 10	12 x 10	10 x 12	12 x 12	13 x 12
Steam In. Diam.	2	2	2½	3	2½	3	3½	3½	4	4
Exhaust In Diam	2¼	2½	3	3½	3	3½	4	4	5	5
Length, In.	66	76			89			110		
Width, In.	42	48			56			64		
Height, In.	44	47			53			62		
Weight, Lbs.	500	620			1200			1850		

STURTEVANT HIGH-SPEED ENGINES

The B. F. Sturtevant Co. makes a simple high-speed engine of the following dimensions:

Steam pressure lbs. gauge	80	40	35	120	80	120	80
Kw.		20			30		40
Speed, R. P. M	375	250	250		350		300
Size, In.	8x8	15x8	15x10	8x10	10x10	10x10	11x10
Steam In. Diam.	2½	3	3	2½	3½	3	3½
Exhaust In. Diam.	3	3½	3½	3	4	3½	4
Length, in.	77¼	83½	98½	97¼	97½	102½	102½
Width, in.	64¼	69¼	76¾	75¼	76¾	80¼	80¼
Height, in.	47	50¾	55¼	55¼	55¼	59	59
Weight, lbs.	5000	6000	8600	8000	8300	9200	9400

Steam pressure, lbs. gauge	120	80	120	80	120	80
Kw.		50		60		75
Speed, R. P. M.		275		275		275
Size, in.	10x12	13x12	12x12	14x12	12x14	14x14
Steam, In. Diam.	3	4	4	5	4	5
Exhaust, In. Diam.	3½	4½	4½	6	5	6
Length, in.	117¼	118¼	118	121¼	134½	135
Width, in.	99¾	100¾	100¾	100¾	111	111
Height, in.	69	69	69	69	75½	75½
Weight, lbs.	14250	15000	14750	15200	19300	19800

Steam pressure, lbs. gauge	120	80	125	100	125	100
Kw.		100		125		150
Speed, R. P. M.		250		250		250
Size, in.	14x14	16x14	14x16	16x16	16x16	18x16
Steam In. Diam.	5	5	5	6	6	6
Exhaust, In. Diam.	6	6	6	7	7	7
Length, in.	138¼	141	154½	153	153¾	159¼
Width, in.	112¾	112¾	120	120	131½	131½
Height, in.	78	78	82	82	84	84
Weight, lbs.	24000	24000	30500	30750	33500	33700

edly place these engines again on the market for the benefit of the individual customer.

Engines must be supplied with the following equipment to meet the U. S. Government specifications:

(*a*) Re-throttle valve for starting and stopping the unit.

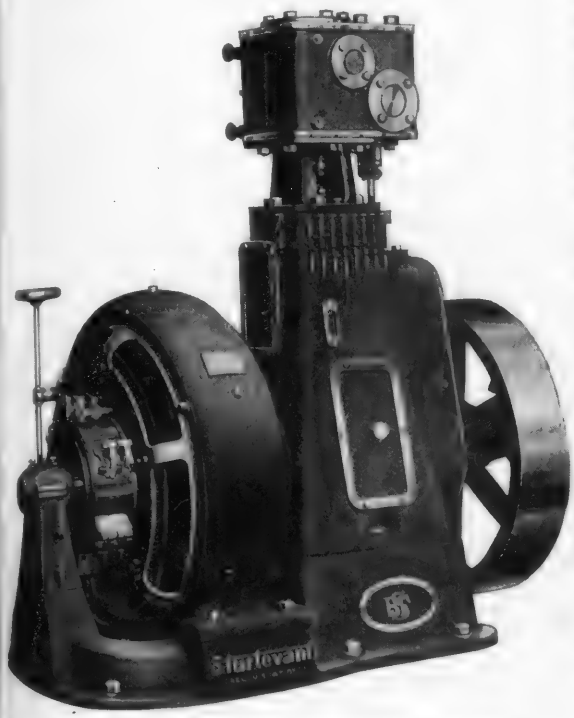
(*b*) Automatic cylinder relief and drain valve.

(*c*) Cylinder lubricator with piping, etc.

(*d*) Metal packing for piston rods and valve-stem stuffing boxes.

(*e*) Auxiliary hand oil-pump.

(*f*) Steam chest drain connections with valves.



STURTEVANT SIMPLE HIGH-SPEED ENGINE.

(*g*) Indicator piping with threeway cocks and angle globe-valve.

(*h*) Attached indicator reducing motion.

(*i*) Adjusting wrenches mounted on hardwood panel.

(*j*) All necessary drip, drain and indicator piping of nickel-plated brass pipe above the floor.

After erection the engines and generators should be rubbed smooth, painted two coats of very dark green (or else a dark maroon or wine red) paint and striped with gold leaf after which varnish should be applied.

Almost every engine can be obtained either "right-hand" or "left-hand," as shown in Fig. 2. The easiest hand to obtain is the right-hand, all engines being built or carried in stock in this hand; left-hand engines are sometimes, but not always carried in stock. For this reason it is preferable to use "right-hand" engines where all other conditions are equally suitable to either hand. The distinction between a "right-hand" and "left-hand" apparatus is determined by standing at the cylinder and looking toward the shaft; if the eccentric is on the right-hand side of the piston rod the engine is "right-hand" while if it is on the left-hand side the engine is "left-hand."

It is also desirable that the engine should "run over" rather than "run under" owing to there being less liability to knock, due to the centrifugal force of the crank and connecting rod. By "running over" is meant that when standing at the cylinder and looking toward the shaft the crank at the top portion of its revolution is receding from the observer while, if running under, the crank during the top portion of its revolution is approaching the observer.

One of the greatest helps to successful engine operation is the providing of a sufficiently heavy foundation to absorb the thrust of the reciprocating and unbalanced parts. Engines and other vibrating machinery may be supported on comparatively unstable framing if a foundation of sufficient mass is provided to properly absorb the vibration. As a general thing a foundation from 3 to 4 ft. thick on a 100 Kw. engine up to 7 to 10 ft. thick on a 1,000 Kw. engine will be found amply massive for this purpose.

A good test of the proper balancing of an engine and a proper steadiness of running can be made by standing a coin on edge on the top of the cylinder or other portion of the machine. If the coin remains standing the engine has but little vibration but if it falls over repeatedly the engine is either out of adjustment or the foundation is too light. Needless to say, the test coin used should be a comparatively new one on which the corners have not become excessively rounded.

Notes

Broken parts of the power-plant—particularly crankshifts—have been becoming increasingly difficult to deal with owing to slow delivery of new shafts and the almost impossibility of finding any spare shafts in stock. That the old shafts can be repaired as good as new, however, is the encouraging claim made by the Goldschmidt Thermit Co.,

of New York, which has made many such repairs. The company states that it has never yet heard of a thermit weld breaking under regular service conditions.

A grease and oil interceptor is shown herewith, this being a simple device for catching and retining oil and grease carried out of the plant in the "dirty drip" discharge. It also has the added advantage of keeping this undesirable element out of the sewer. The oil and grease floating on the surface are prevented from reaching the outlet by the baffle, while scale, dirt and other "heavier than water" substances are retained in the bottom of the first compartment by the dam. A removable cover gives access to the interior for removing the oil and grease and to clean out the material retained behind the dam.

For overloaded boilers the period of fire cleaning sometimes comes at very inopportune times. The Thomas Grate Bar Co., Birmingham, Ala., advocates the use of their "wiggling-shaking-dumping" grate bars by means of which the cleaning period is not only eliminated but the fires are kept in the very best possible condition at all times. The opening of furnace doors for slicing, cleaning, etc. is also avoided.

LEGAL DECISIONS

Heating and Humidifying Air Patent.

In a suit for infringement of a patent (Carrier patent No. 854,270) for a method of heating and humidifying air. The federal district court for the Western District of New York holds that a patent for a method cannot be sustained when it appears that the result achieved is due to the operation of a machine; but when the new result comes from certain acts, or a series of steps, irrespective of mechanism or the mechanical assemblage, then the steps taken, or the acts performed, or the method of treatment involve patentable invention. The court held the patent in question valid, irrespective of any automatic regulation of the temperature and humidity of the air by the aid of a thermostat or other mechanical instrumentality, inasmuch as the process was not entirely dependent upon the use of a thermostat; the performance of its function being due to the use of water at a temperature higher than that of the air and below the boiling point, which was first caused to contact intimately with a current of air into which the heated water was sprayed. Such steps increased the temperature of the air, which then vaporized or assimilated the moisture, the relative humidity of the air depending upon the temperature of the air. The thermostat was arranged to come within the influence of the heated and humidified air, and while in that condition operated to maintain the water at a proper temperature to increase the temperature of the air to the point of saturization, or to what is known as dew point, meaning a degree of temperature having a certain amount of humidity below which it cannot be reduced without first condensing the moisture content from the air. The intimate contact of the air with the water is brought about by the action of a pump, which draws the warm water after circulation through the apparatus into a well, the warm water then flowing through a bypass piping for regulation by the thermostat placed in the room in which the humidity is to be controlled. As the patentee's invention was a departure from prior processes, the claims of his patent were held entitled to a fairly reasonable construction, which will not permit another, by changes of form only, to appropriate the substance of his invention. *Buffalo Forge Co.* v. *City of Buffalo,* 246 Fed., 135.

Independent Contractor.

In an action for personal injuries it appeared that the defendant engaged an independent contractor to construct a concrete building. The plans and specifications were adequate and skillfully drawn. The building having been completed the defendant engaged another independent contractor to install the plumbing and heating apparatus. The plaintiff, an employee of a subcontractor of the latter, was injured while doing plumbing work by the collapse of the building. The building, which was of reinforced concrete work, was constructed in early winter. At that time the work was not inherently dangerous, as proper steps could be taken to prevent the freezing of the concrete. It was held that the plaintiff could not recover merely because of the fall of the buiulding, without proof of the defendant's negligence, on the theory of *res ipsa loquitur,* the defense that the work was being done by an independent contractor being available to the defendant. *Looney* v. *Prest-O-Lite Co.,* Indiana Appellate Court, 117 N. E., 678.

The War and the Heating Engineer

New Food Card for 1918

The programme set forth by the United States Food Administration for 1918 is as follows:

Two wheatless days (Monday and Wednesday) in every week, and one wheatless meal every day.

One meatless day (Tuesday) in every week and one meatless meal every day. Also two porkless days (Tuesday and Saturday) every week. As a nation, says the food administration, we eat and waste nearly twice as much meat as we need.

Make every day a fat-saving day. The food administration estimates that we use and waste two and one-half times as much fat as we need.

Make every day a sugar-saving day. Our waste of sugar, says the food administration is about twice the amount needed.

Use fruit, vegetables and potatoes abundantly.

Use milk wisely.

Do not limit the food of growing children, advises the food administration, eat sufficient food to maintain health, and preach and practice the gospel of the "clean plate."

Heatless Monday.

In view of the institution of "Heatless Monday" as a measure apparently designed to save one-seventh of the week's coal supply, may the writer call attention to some features of the subject which are well understood by all practical engineers, but not a subject to which the general public has evidently given attention?

It will be found out later that, instead of one-seventh of the coal being saved, a much smaller saving has actually been realized, due to a number of causes among which is the fact that it is impractical to entirely shut off heat from large buildings on account of the danger to merchandise, the possibility of freezing pipes, and, the extraordinary amount of coal that would have to be used for many hours before occupancy to again bring the temperature back to 70°.

In their patriotic efforts to carry out the government order, engineers have tried to reduce temperatures to about 45° or, say, a saving of 35%, which is not realized for the reason that the walls having attained a degree of high temperature together with the large volume of air, give off their accumulated heat. Consequently it may take, say, eight hours of the twenty-four to realize the required reduction of temperature. It, therefore, becomes questionable if, after adding this heat loss to that lost in extra firing during the twenty-four hours to re-establish the 70° temperature, there accrues any saving whatsoever.

It is also true that in most factories, especially where the work of both heat and power are practically balanced, heat becomes a by-product of power. In other words, power and heat can be made just as cheap as either one alone and in many instances the engineer will substantiate the claim that heating alone costs more per day on holidays and Sundays than on week-days, although reduced as much as is practical to effect economy.

Another circumstance, no doubt typical, consists in turning off heat from all radiators on Saturday evening and indiscriminately turning heat on again on Tuesday when, as a matter of fact, very little additional heat is necessary in some rooms, due to risers passing through them, while in others similarly situated and unoccupied radiators are turned on full. In such instances a clear case of loss exists rather than gain.

Acting on the theory that criticism is an expression of ignorance unless of a constructive character, the writer offers the following suggestions for actual coal saving:

1. Householders to shut off heat entirely from bedrooms and others not in actual use.
2. Reduction of day temperature to 65° and allow the extra underwear properly worn in the winter season to provide the warmth for which it is intended, thereby assisting in the prevention of colds and doctor's bills.
3. The steam-heated flat and business office, which have done so much to

populate our graveyards with consumptives, should also be similarly regulated.

4. Workshops should be reduced from 65° to 60°, depending on the nature of the employment.

Assuming that the above day-temperatures are steadily maintained and a practical and economical reduction of night-temperatures (not to exceed 15°) be also maintained, it then becomes but a simple matter of figures and practical proof that, whereas, under the system of "Heatless Monday"—which should at best but a small and questionable saving of fuel for one day—there is a six-day saving from 12% to 15%, besides the saving to both capital and labor so much needed and attainable by the application of rules which are the result of practical experience.—*W. H. Pearce, Chicago.*

The Blue-Card W. S. S. Pledge.

A marked impetus to the sale of war-savings and thrift stamps has been given by the distribution of blue post-cards order blanks which may be filled out and mailed postage free. The stamps will then be delivered C. O. D. The cards can be obtained in quantities at any post office, bank and from letter-carriers. Special emphasis is laid on the convenience of the blue card for trade agents when ordering supplies.

Already 350,000 war-savings stamp agencies have been established. There will also be 1,000,000 "sales stations." 50,000 post offices now have war-savings stamps on sale and 29,000 banks and 8,000 individual firms and corporations have been appointed agents.

Preparing for the Next Liberty Loan

It is now well-known that the observance of meatless days has not only helped materially to feed our fighters and allies, but has also helped to swell our individual bank rolls. We are richer for this patriotc effort.

"What are you going to do with that extra money?" asks those handling the forthcoming loan, "frivol it away; blow it on some extravagance of which you will soon be ashamed? Or will you salt it away for your own good and that of your country and civilization?" You are confronted with an ideal opportunity of spreading the good effect of your initial patriotism by investing the money you have saved thereby in Liberty Bonds. There are, of course, no better securities than those which the government offers. Very soon the government will be asking you to buy bonds of the third and greatest Liberty Loan. Keep that money you are saving that you may respond to this call in the great American way.

Louisville as a Manufacturing Center

Louisville, Ky., has the distinction of possessing electric power for industries in excess of its present demands. During the past winter this excess has been about 10,000 k. w. This condition is largely due to the fact that the central station owns the mine from which it draws its coal supply and owns its coal cars. Its coal mine is a night's run from Louisville, assuring a plentiful supply of fuel and continuity of electric power.

The movement of residents to suburban districts has also made available in Louisville several thousand modern dwellings at moderate rentals which are said to be especially suited to the living requirements of labor. The foregoing facts are being featured by the Louisville Industrial Foundation for the benefit primarily of manufacturers of war materials.

Heating Men in Military Service.

Four of the heating superintendents of Hopendyl, Hardy & Co., New York, which operate a number of central station heating plants in the Middle West, are now in the service of the government.

F. W. Gano, who was originally located at the company's plant in Peoria, was the first to enter the service. He is now an artillery officer, with the rank of second lieutenant.

R. V. Stureman, of Springfield, Ill., entered the service as sergeant in the Quartermaster's Corps, was afterwards recommended to a second lieutenancy in the Engineers' Corps and has recently been appointed first lieutenant in the same corps. He is now in Houston, Texas.

F. E. Thompson, of Evansville, entered the second Officers' Training Camp at Fort Benjamin Harrison, Indianapolis,

Come on, Men, 250,000 of You!

This is Your Badge of Honor
Wear It Proudly

Launch a Blow at the Kaiser by Helping Launch a Ship

The Man of the Hour.

Who says we can't build ships?

Come on, you loyal American Mechanics, masters of familiar trades, and brand this "made in Germany" insinuation by building a bridge of ships to Pershing.

This does not mean that you are to give up your regular job and rush off to some shipyard which at the moment, may not be able to accommodate you. Quite the contrary! Your enrollment simply shows that you stand ready, when called upon, to do a particular job for a particular wage in a particular place. Everything will be in readiness for you, and you will loose no time.

Ships are not things of mystery; they are merely big buildings afloat—the product of everyday skill and industry—and the American Mechanic (hats off to him) can build them.

Where can YOU qualify in the following list?

Acetylene and electrical welders	Dock Builders	Painters
Asbestos workers	Chippers and calkers	Plumbers and pipe fitters
Blacksmiths	Electrical workers	Sheet-metal workers
Anglesmiths	Electricians	Coppersmiths
Drop-forge men	Wiremen	Shipfitters
Flange turners	Crane operators	Structural iron workers
Furnace men	Foundry workers	Riveters
Boiler makers	Laborers, all kinds	Erectors
Riveters	Loftsmen	Bolters up
Reamers	Template makers	Other trades
Carpenters	Machinists and machine hands, all sorts	Cementers
Ship carpenters	Helpers	Crane men

CLIP THE COUPON AND GET THE FULL STORY

Edward N. Hurley, Chairman,
U. S. Shipping Board,
Washington, D. C.

I wish you would send me at once further information, telling me how I can enroll as a member of the U. S. Shipyard Volunteers of the Public Service Reserve for employment in shipyards and so help win the war.

My Trade is .....

My Name is .....

Street Address .....

Town..... State.....

and was afterwards transferred to Fortress Monroe, where he received a commission as second lieutenant in the Coast Artillery. He was one of 300 of this camp who volunteered to go to France immediately and is now "somewhere in France."

B. A. Lowe, who was originally superintendent of the heating department in Springfield, O., and was tranferred to Evansville to take Mr. Thompson's place when he entered the service, is now in the third Officers' Training Camp at Chillicothe, O.

W. G. Boales, of the New York office of the Hoffman Specialty Co., Chicago, has been appointed inspector of shells. He is at present located at Jefferson Barracks, St. Louis, and expects to be transferred soon to France.

H. L. Whitelaw of the American Radiator Co., Chicago, Ill., is now a second lieutenant in the Royal Flying Squadron, of Canada.

Benjamin Nelson, of the Chicago office of Warren Webster & Co., Camden, N. J., has been commissioned first lieutenant in the Ordnance Reserve Corps. He is stationed at Springfield, Mass.

Richard S. Bull, of Chicago, a member of the Illinois Chapter of the heating engineers' society, has been commissioned a captain of field artillery. He is stationed at Rockford, Ill.

To Promote Dehydration.

A resolution urging the Government to use dehydrated vegetables in the army and navy ration was passed recently by the Woman's Committee of the California Council of National Defense. It is believed that dehydration will make it possible to save surplus farm products in California which might otherwise go to waste; that there would be a saving in bulk and cost over canned goods; that government orders for dehydrated products would encourage the establishment of a healthy dehydrating industry; that the use of these products by the army and navy would assist in bringing them before the general public. The resolution reminds our Government that the British, French, and German armies are now using enormous quantities of dehydrated vegetables with satisfactory results, and that a Canadian firm is supplying 2,000,000 lbs. monthly of dehydrated vegetables to the French and British armies.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Organization of the Council.

The new council of the heating engineers' society has organized as follows: executive committee: W. H. Timmis, Homer Addams and J. I. Lyle; publication committee, Champlain L. Riley, E. Vernon Hill and F. G. Phegley; finance committee, Homer Addams, W. H. Driscoll and H. P. Gant; membership committee, Howard Fielding, C. W. Kimball and F. W. Powers. At the organization meeting a special vote of thanks was accorded Secretary C. W. Obert who was re-elected.

Illinois Chapter Holds War Session.

"Engineering Problems at the Front," and "Constructive Dectective Work at Home" were the subjects of two addresses delivered before the Illinois Chapter of the heating engineers' society at its January meeting, held at the Engineers' Club, Chicago, January 14. The speakers, both of whom were secured by J. F. Tuttle, were Sergeant B. S. Wolf, of the Thirteenth Engineers, who has seen service in France where he was wounded and who was on the torpedoed steamship Finland, and Hinton C. Clabaugh, superintendent of the Federal Department of Justice, at Chicago.

The speakers were introduced by Mr. Tuttle, President E. Vernon Hill relinquishing the chair for this purpose.

Sergeant Wolf, who was the first speaker, described the sanitary facilities provided for the troops at the front, the members being especially interested in the provisions made for hot-water shower baths. He told of his journey across the Atlantic, the reception of his regiment in England, where it was given a luncheon in Windsor Gardens, adjoining Buckingham Palace, after being reviewed by the king and queen. Sergeant Wolf confirmed the stories of the capture of young German prisoners and of the growth of internal troubles in Germany. He concluded with an account of the torpedoing of the Finland. He stated that he was in the water several hours clinging to a piece of wreckage and was finally picked up by a passing vessel in an unconscious condition.

Mr. Clabaugh, the second speaker, gave

an equally interesting address on the work of his department which has to do with the detection of disloyalty to the United States. He said there were many amazing cases of disloyalty and gave details of a number of typical cases. He also paid high tribute to the great numbers of citizens who have co-operated with his department in the apprehension of alien enemies.

At the conclusion of his address a rising vote of thanks was accorded both speakers.

In order to further the work of fuel conservation, a motion was passed that a committee of three be appointed to devise plans to this end. The personnel of this committee and the set of rules and suggestions later drawn up are presented in another column.

The subject for the February meeting was "The Relation of the Medical Profession to the Heating and Ventilating Engineer," the speaker being Dr. W. A. Evans, formerly health commissioner of Chicago.

Illinois Chapter Formulates Rules for Handling Boilers.

Considerable publicity is being given to the efforts of the Illinois Chapter to provide the public with directions for handling boilers and warm-air furnaces. These rules have been reproduced in full in two of Chicago's daily papers. They are not intended for large consumers, but for householders and not for apartment house janitors, but for laymen who know little of the science of coal saving.

The suggestions were compiled by a committee consisting of J. F. Tuttle, chairman; James H. Davis and Charles G. Lamb and are presented in such a way that they may be cut out and pasted on a card for reference. Following are the rules in full:

SOFT COAL

1. Thoroughly clean flues and passages of boiler or furnaces at least once a day.
2. Steam boilers should be blown out under pressure to remove grease and dirt. This is very important and should be done at once by an experienced man. Hot water plants should have water renewed in full before starting heating season.
3. Clean base of chimney and smoke-pipe once a year.

METHOD OF FIRING

1. Fire often and lightly, keeping grates fully covered.
2. Do not spoil fire by stirring it around or mixing it up.
3. Use slice bar under fire bed on top of grates, lifting only enough to break or crack open the mass. Keep fire free from clinkers.
4. In large boilers or furnaces use the alternate method of firing; first, one-half of grate, and next, firing the other half. This is done to have a bright fire to assist in burning the gases from the coal just fired and to make heat until the fresh coal ignites.
5. Don't smother your fire.
6. Use the smaller prepared sizes of coal if possible. If you cannot get the small coal, break the large coal into small lumps. Wet all soft coal thoroughly before firing.
7. The best way to fire round boilers or furnaces is to get the house warm by firing lightly and often. Then fill fire-pot full of wet coal. Next take a piece of pipe or broomstick and poke a hole down through the fuel-bed to the grate. Carefully withdraw and leave hole in fuel bed. Check off the draft so that it will not burn too rapidly. This hole soon will carry a large blue flame, which is gas driven off from the fresh coal. If this method is followed, the gas will not be lost up the chimney.

ASHES

1. Don't shake grate violently. It wastes coal.
2. Keep ash pit clean.
3. Never allow ashes to get within 6 in. of grate.
4. Remove ashes from last shaking before shaking again.

DRAFT

1. Be sure your chimney is large enough, high enough and absolutely tight.
2. Do not allow any connections to be made to the heating chimney, excepting the heating boiler or furnace alone.
3. Regulation of draft is very important in saving coal and should be attended to at once by an experienced man. If you cannot regulate your draft be sure to call for assistance.
4. The draft to ash pit should not be open any more than necessary to maintain the desired temperature.
5. Do not open ash pit door to increase draft. Use draft damper under grate provided with boiler or furnace for this purpose.
6. Check draft must not be open unless draft damper under grate is closed.

HARD COAL

1. Thoroughly clean flues and passages of boiler or furnaces at least once every week.
2. Steam boilers should be blown out in same manner recommended for soft coal. Also clean base of chimney in same manner.

METHOD OF FIRING

1. In using anthracite coal a bright fire should always be kept if you wish heat. In building up a fire use a small quantity often with good draft until the fire pot is full to the center of fire door. Draft then can be checked to hold the heat desired.
2. A hard coal fire should never be disturbed by stirring or breaking up with a poker.
3. Remove clinkers, if any, through grate or clinker door.
4. Use size of coal recommended by maker of boiler or furnace. Don't wet hard coal.

ASHES

Rules same as for soft coal.

DRAFT

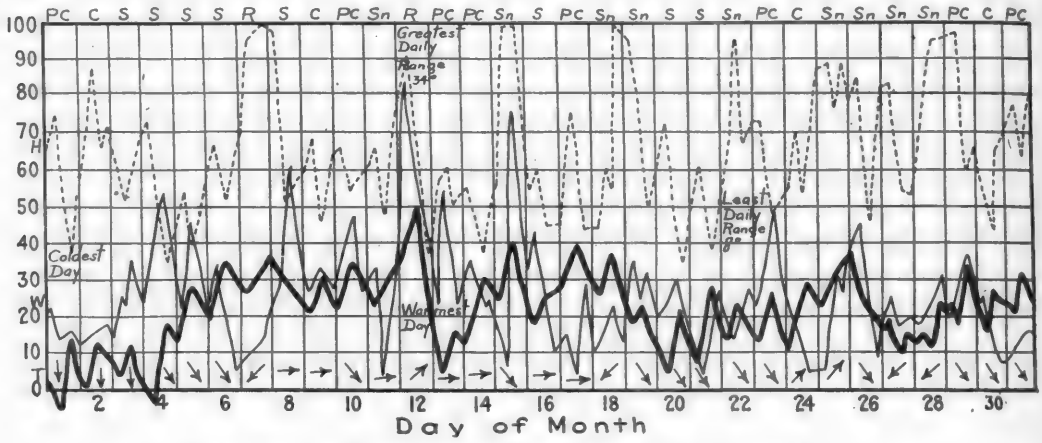
Rules same as for soft coal.

GENERAL REMARKS

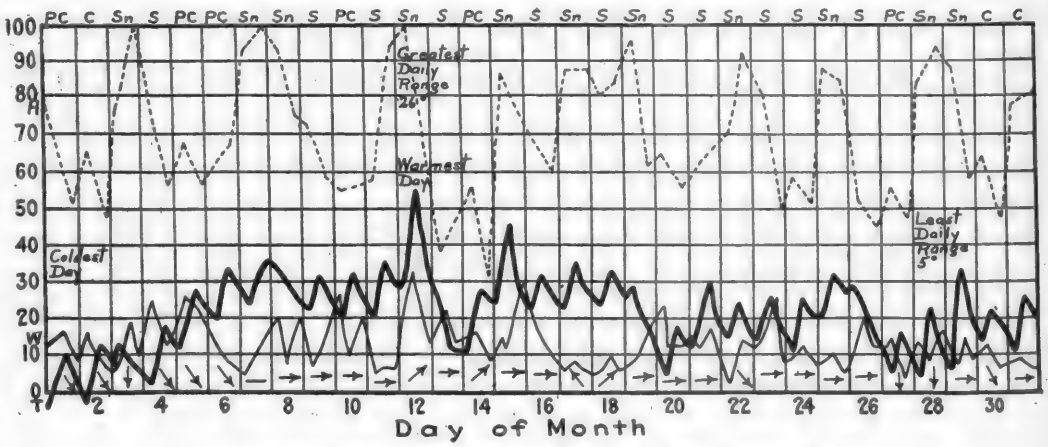
1. Cover boiler and pipes with asbestos or other insulation; also weather strip your windows and doors or stuff cracks with cotton.
2. Keep your room at 68° F. (best heat for health.)
3. Heat only the rooms you use all the time.
4. Close bedroom doors when windows are open and shut off radiator.
5. When any room is kept at a lower temperature than balance of rooms keep door closed.
6. Protect a hot-water radiator in room when windows are open by throwing a blanket or rug over radiator. Radiator may then be shut off without fear of freezing.
7. Use hot water sparingly, as every gallon of hot water wasted means loss of coal.

The Weather for January, 1918

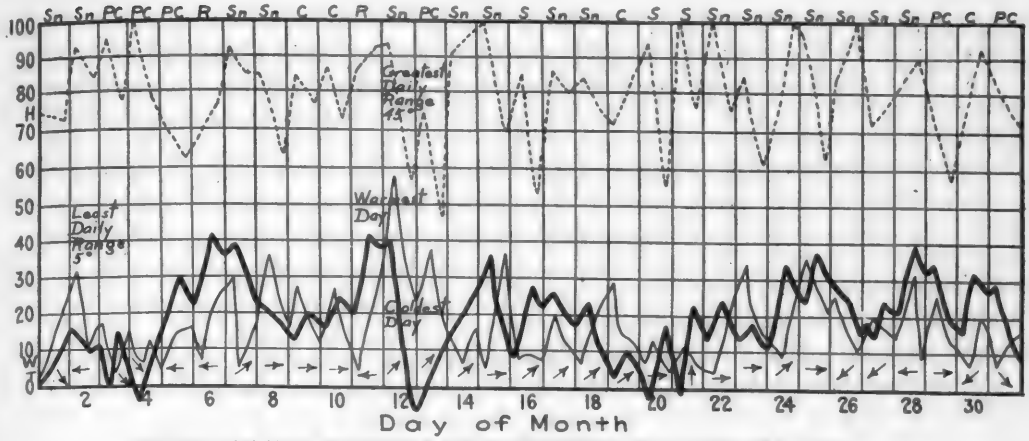
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	50	54	41	35	45
Date of highest temperature	12	12	11	25	25
Lowest temperature, degrees F.	−5	−3	−5	−14	−17
Date of lowest temperature	1	1	12	12	12
Greatest daily range, degrees F.	34	26	45	26	29
Date of greatest daily range	12	12	12	23	11
Least daily range, degrees F.	8	5	5	5	4
Date of least daily range	22	28	2	2	27
Mean temp. for month, degrees F.	21.6	21	19	13.3	18.8
Normal mean temp. for month, deg. F.	30.2	27	30.7	23.7	31
Total rainfall, in.	3.41	3.11	2.82	4.12	1.31
Total snowfall, in.	13.6	13.8	19	42.5	11.7
Normal precipitation, this month, in.	3.79	3.82	2.87	2.00	2.27
Total wind movement, miles	15057	8955	9878	10699	10336
Average hourly wind velocity, miles	20.2	12	13.3	14.4	13.9
Prevailing direction of wind	N. W.	W.	S. W.	W.	N. W.
Number of clear days	8	11	4	9	6
Number of partly cloudy days	10	8	6	7	13
Number of cloudy days	13	12	21	15	12
Number of days on which rain fell	5	1	2	..	1
Number of days on which snow fell	9	11	15	15	8
Snow on ground at end of month, in.	4.6	4.6	7.2	23.8	0.7


PC C S S S S R S C PC Sn R PC PC Sn S PC Sn Sn S S Sn PC C Sn Sn Sn Sn PC C PC
Greatest Daily Range 34°
Least Daily Range 6°
Coldest Day
Warmest Day
H
W
T
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

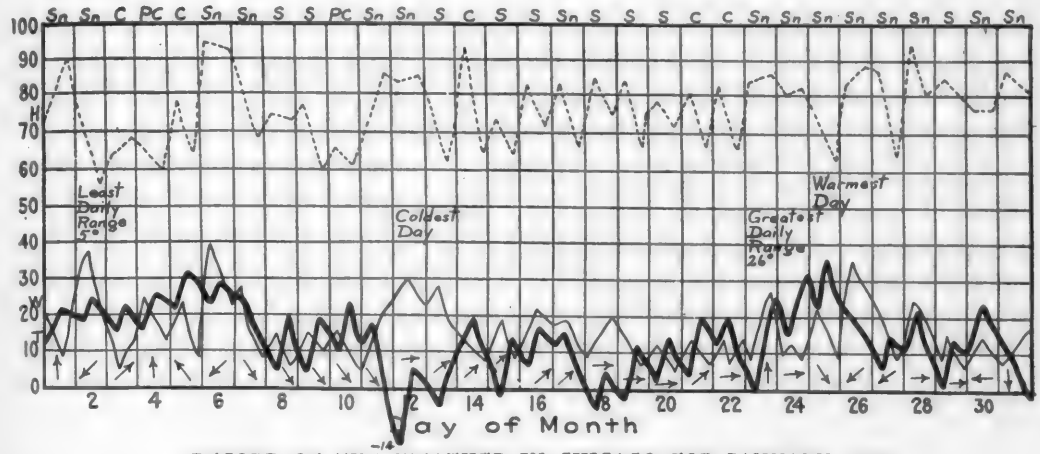
RECORD OF WEATHER IN NEW YORK FOR JANUARY, 1918.
(Hourly observations of the Relative Humidity are Recorded on this chart)


PC C Sn S PC PC Sn Sn S PC S Sn S PC Sn S Sn S Sn S S Sn S S Sn S PC Sn Sn C C
Greatest Daily Range 26°
Least Daily Range 5°
Warmest Day
Coldest Day
H
W
T
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

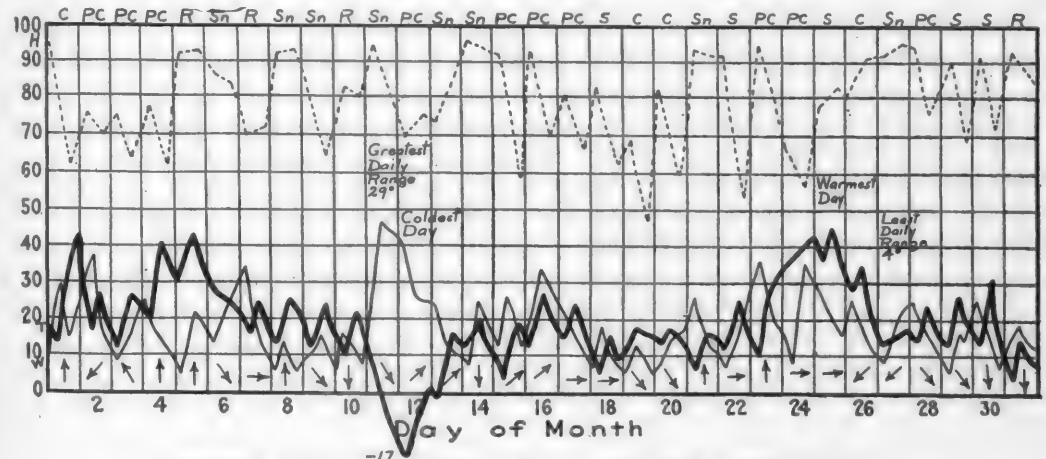
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1918.



RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY, 1918.



RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1918.



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1918.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

NATIONAL DISTRICT HEATING ASSOCIATION

Data Wanted on Underground Construction Troubles.

Difficulties experienced with underground construction for pipe lines and the methods taken to overcome them, are being investigated by the Underground Construction Committee of the National District Heating Association. Manholes surrounding fittings in the heating mains, particularly high-pressure steam mains, says the committee, are one of the greatest sources of heat loss. This heat loss is concentrated in the manhole head which is in direct contact with the pavement.

The damage to pavements, particularly asphalt, is a continual cause of complaint from the city highway departments and the property owners. Sunken pavements around manhole heads are also a continual source of damage claims as well as a continual source of expense, due to repaving charges.

In order to get information on this subject the committee is sending out a list of questions, as follows:

A. What class of mains do you operate?
   High-pressure steam?
   Low-pressure steam?
   Hot water?
   (Give operating pressure).
B. What type of manhole do you use?
   Concrete?
   Brick?
   Cast-iron sectional?
C. How do you insulate the fittings in your manholes?
   (Give details).
D. Do you have trouble with pavement around manhole heads?
   What kind of payments?
   (Describe trouble and state inside temperature manhole when closed.)
E. What valves, traps, fittings, expansion joints, or specials in manhole?
F. Do you pave around manhole head in special manner?
   (Give details and sketch).
G. What have you done to overcome heat losses at manholes?
H. What suggestions have you to offer regarding construction of manholes, such as insulating sidewalks, etc.?
   (Give details and sketch).
I. What suggestions have you to offer regarding special insulation of fittings in manhole?
   (Give details).

The chairman of the committee is H. A. Austin. 280 Madison Avenue, New York.

CORRESPONDENCE

Heat Loss and Leakage Loss Factors.

EDITOR HEATING AND VENTILATING MAGAZINE:

Commenting on your heating charts which you are publishing each issue, I would like you to publish the loss factors for metal sash, both for double-hung windows, for the fenestra style, for solid sash and the kind with the pivoted movable centre section, also the loss per degree difference for constructions such as are being used in the present army cantonments.

Another important building construction that you have apparently not covered, is the asbestos shingles, both for roofs and side walls. A great deal of this kind of structure is being used at the seashore.

Still another is the rubberoid roofing, which is about ⅛-in. thick. I do not mean the ordinary tar paper. It is also used to make the outside cover on overhead outside mains.

I shall look forward with interest to the publishing of a sheet with these very important factors given.

Philadelphia, Pa. R. G. E.

It is with great pleasure we print the above letter and it is just the sort of comment for which we are looking. The only way we can improve, enlarge and make our Standard Data Sheets of the greatest value is to have them cover items of interest such as our correspondent has pointed out. We hope more of our readers will co-operate with us to the extent of signifying information which they would like to see incorporated in the Standard Data Sheets.

In regard to the metal sash, the loss factors for glass have already been published and the losses for glass in any sort of sash are all alike; what our correspondent probably means is how much shall be allowed for leakage on metal windows of various designs. One of the most authoritative discussions on this subject is contained in the paper on "Window Leakage" presented before the A. S. H. V. E. in 1916 by Stephen F. Voorhees and Henry C. Meyer.

The metal sash tested involved many kinds, the names of the manufacturer being omitted, and the results compared by means of curves. It is stated in this paper that the leakage for metal sash is very variable and a building is cited in which the radiation in all rooms having metal sash was increased 33⅓%

above normal which added amount did not prove to be enough in some cases, while in others it was excessive, showing a great difference between different windows of the same manufacturer and in the same installation.

The results of these tests show that, at an air pressure equivalent to a wind velocity of 100 miles per hour, the *total* leakage of windows under various conditions expressed in cubic feet of air per minute per linear foot of sash perimeter is as follows:

Type of Sash		Cu. Ft. per Min. per Linear Foot Perimeter
Pivoted window "Style A"	plain	1.30
Standard wood window	weatherstripped	2.35
Hollow metal	weatherstripped	4.33
Hollow metal	plain	5.90
Hollow metal	plain	6.30
Hollow metal	weatherstripped	6.80
Hollow metal	weatherstripped	8.33
Pivoted window "Style B"	plain	9.10
Copper covered	plain	9.20
Hollow metal	weatherstripped	11.00
Standard wood window	plain	11.40
Hollow metal	plain	11.50
Hollow metal	plain	12.40
Hollow metal	plain	15.33
Hollow metal	plain	18.95
Hollow metal	plain	19.20

From this it can be seen that the comparative leakage between plain wooden sash and plain hollow metal is 80% greater for hollow metal in the worst case. With good weatherstripping the metal window leakage runs about 100% greater than wooden sash weather-stripped, but with poor weatherstripping it is not impossible for the metal sash to go up five times the leakage of weather-stripped wooden sash.

In the near future an additional sheet on "Leakage" will be issued to cover the subject of metal windows, but owing to the fact the pressure difference of 3.75 in. of water (equal to a wind velocity of 100 miles per hour) could never be maintained in practice, due to the room pressure building up inside and reducing the differential it is probable that the leakage on any sash would not amount to over 50% of that indicated in the test.

The army cantonments for officers training camps (according to W. J. Maurer of the Chicago Department of Health, Ventilation Division, in a paper read before the A. S. H. V. E. last July) are built with ⅞-in. battened sides and roof with the roof covered with roofing felt saturated with asphalt The sides are only carried up to within 3 in. of the roof, this space being left open for ventilation. The barracks for drafted men are similar in construction but with metal roofs and the 3-in. space omitted, the windows being depended upon for ventilation.

We see no reason why ⅞-in. boards with batten joints would not have a heat loss practically equal to the loss for frame construction (Data Sheet No. 1-E) consisting of studs and clapboards on one side. Ventilation to the extent of three or four changes per hour at least must be figured to keep up a sufficient air renewal to make these buildings reasonably healthy.

In regard to asbestos shingles and rubberoid roofing we are inquiring of the manufacturers if tests have ever been made for heat losses on such material. If authoritative data is procurable it will be incorporated in the Data Sheets.

Problems in Calculating Required Radiation.

EDITOR HEATING AND VENTILATING MAGAZINE:

Can you furnish me with answers to this list of questions over which I am puzzled?

How far below grade do you figure heat losses on outside walls and do you figure floor losses in heating basements?

In figuring the radiation for rooms used as cafés, etc., where a good many people pass in and out, is one air change per hour enough?

Is 1⅓ times the horsepower required to supply the radiation enough to give about the right margin of safety?

What per cent of steam is lost in passing through engines and what additional horsepower, if any, does it require?

I would like to have a rule for the size of the blowoff tank required.

Pittsburgh, Pa. H. F. S.

It is not our policy to advocate the figuring of heat losses below the grade line. This is because the earth on the outside of a basement wall where the building is kept constantly, or almost constantly, heated gradually approximates the wall temperature so that the major portion of the heat transmission soon ceases; this is even more true with the earth under basement floors. For this reason it has proven perfectly feasible to figure only the wall, glass, and ceiling surface above the grade line and *buildings so calculated* have given every *satisfaction* by maintaining the required inside temperature during extreme weather. In fact, owing to the greater protection from the wind, their temperature is less likely to be affected by gales than rooms entirely above ground.

While some engineers *do* figure dirt floors, and walls below grade, the only result is to increase the radiation required to a very small degree as the losses so figured do not amount to much. It is very necessary, however, to place in such rooms sufficient radiation to counterbalance all the heat losses above the grade and also one air change per hour if the room is unventilated. (See Standard Data Sheet No. 3 in the April, 1917, issue.)

As to the second question, we recommend doubling the radiation near any outside door but in cases where the doors are constantly opened and closed this, of course, would not be enough to meet such excessive conditions. In places such as store entrances, etc., it is usual to install vestibules with inner and outer doors, the radiation being figured for the heat loss of the vestibule plus three or four air changes per hour.

If the heat loss of the vestibule approximates the number of B.T.U. required for one air change then the heat loss would equal X and one air change will also equal X the normal computed radiator being equal to X + X or 2X. Doubling this gives a radiator of 2X × 2 = 4X of which X supplies the heat loss and 4X — X, or 3 X, is available for warming air. As one air change requires X radiation 3X will furnish heat for three air changes and tripling the radiation would give enough for 2X × 3 = 6X total; 6X — X = 5X, or five air changes per hour. In extreme cases it may be necessary to triple the nominal surface obtained by calculating on one air change as called for in the Standard Data Sheet.

Answering the third question, the boiler horsepower is quickly obtained from the *equivalent* direct radiation (E.D.R.) as follows:

$$\text{B.H.P.} = \frac{\text{EDR} + 25\% \text{ of EDR}}{100}$$

That is to say, one boiler horsepower (B.H.P.) will supply 100 sq. ft. of E.D.R. and the loss in the piping and the mains is assumed as 25%. The E.D.R. is total B.T.U. radiated divided by 250, the 250 being the B.T.U. equivalent efficiency of 1 sq. ft. of common direct radiation. By this formula for 10,000 sq. ft. of E.D.R. the total E.D.R., including piping, will be 10,000

Plus 10,000 × 25%.. 2,500

Total..... 12,500 ÷ 100 = 125 H.P. for boiler.

The rating in horsepower for boilers is used almost exclusively for steel boilers and should be based on 10 sq. ft. of heating surface per nominal B.H.P. For the above example then the steel boiler heating surface should be 125 × 10 = 1,250 sq. ft.

This rating of 125 HP is practically 1⅓ times the direct radiator surface considering the fact that some direct surface is probably pipe coils but this ratio would not do where hot-blast heaters are in use owing to their much higher efficiency.

For the fourth question, steam in passing through an engine has a certain portion of its B.T.U. turned into energy and also loses another portion through condensation losses in the cylinder. This results in so small a change in the B.T.U. contained in the steam that it is seldom considered. In fact, there are many engineers who claim that exhaust from an engine will do more heating than an equal amount of high pressure steam. Thermally the exhaust will contain 90 to 95% of the heat contained in the high-pressure steam supplied to the engine, but under all ordinary conditions the heating requirements will be so far ahead of the engine requirements that the amount of heat absorbed in the engine may be safely neglected. Certainly no extra boiler horse-power is provided.

In reply to the last question, the size of the blowoff tank is to a great extent entirely arbitrary. Theoretically the blowoff tank should have a cubic capacity to allow the retention of all the water from the blowing down of one boiler. Actually a great many of the blowoff tanks would not do this if it is figured that a full gauge glass of water is blown down. A rational and practical size of tank can be obtained if assuming 3 in. of water level blown off by the following formula:

C = 7.5 gal. × L × W × 4/12

in which C is the tank contents in gallons,

L is the length of the boiler in feet at the water line,
W is the width of the boiler in feet at the water line,
4 is the number of inches blown down increased by 25%,
12 is the number of inches in one foot.
This can be simplified to

$$C = 2.5\ A$$

if A = the area of the water surface of the boiler.

The reason for adding 25% to 3 in., giving 4 in. approx. is that the blowoff tank is never fully used for water storage, about 25% of its depth being required as a vapor space above the water to allow the steam and vapor to separate freely from the blowoff water, thereby cooling it more rapidly.

New Publications.

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS is the title of a timely handbook prepared by engineers of the Harrison Safety Boiler Works, Philadelphia, Pa. The book is addressed to power plant owners, managers, engineers, and firemen. The preface states that such statements, tables, charts, etc., have been selected as were supported by experiments and tests, references being given wherever possible to the original authorities. The latter include many well-known engineers and writers in technical periodicals, also authors of papers before engineering societies, while the excellent bulletins on the utilization of fuel issued during recent years by the United States Bureau of Mines have been freely drawn upon. Pains have been taken to compare statements and to check each source of information against others.

The work is divided into five sections, the first of which is about "Fuels," under which are considered the coals of the United States and their classifications.

The second section is on "Combustion," taking up the chemistry of combustion.

The third section treats of "Heat Absorption," including heat transmission by conduction, convection and radiation, relation between heating surface and boiler capacity, boiler setting, refractories and fire-brick, soot, scale, softening feed water, and feed-water heating.

The fourth section on "Boiler Efficiency and Boiler Testing" covers heat balance, heat absorbed by boiler, heat losses due to moisture in the coal, efficiencies with different coals, boiler capacity and efficiency, and boiler trials.

The fifth section on "Boiler Plant Proportioning and Management" discusses various arrangements of auxiliaries with regard to their effect upon feed heating, and also describes the Polakov functional system of boiler room management.

The book has been compiled by George H. Gibson, A.S.M.E., assisted by Percy S. Lyon, now Captain of Coast Artillery. The proofs were read by Henry Kreisinger, who conducted for the United States Bureau of Mines many of the investigations quoted in the text.

The volume sells for $1.00 and may be obtained through the book department of THE HEATING AND VENTLATING MAGAZINE.

FIRING BITUMINOUS COALS IN LARGE HOUSE-HEATING BOILERS, by S. B. Flagg is a new publication (Technical Paper 180) received from the Bureau of Mines, Department of the Interior. The bureau has conducted a series of tests with some of the widely-used bituminous coals and this paper contains recommendations based on these tests. Fortunately the recommendations will also apply to those having charge of private buildings and apartment houses.

In view of the statement by Professor Breckenridge at the recent meeting of the heating engineers' society, that we would all have to adjust ourselves before long to the burning of bituminous coal, this new publication should have a special interest at this time. The recommendations on how to burn bituminous coals economically in these large house-heating boilers are as follows:

1. The fuel bed should not be seriously disturbed until the coal has become well coked, that is, until the gassy part of the coal has been largely driven off.

2. Both caking and non-caking types of coal may be used satisfactorily in boilers of this type, if properly handled.

3. The presence of a moderate proportion of screenings mixed with the lump coal causes the fresh charge of coal to heat more gradually and the emission of smoke is kept down more easily. Therefore such a proportion of screenings is an advantage.

4. Increasing the proportion of screenings in the coal necessitates the use of a stronger draft in order to carry the same load. Smaller firing charges must also be used and more frequent attention given. The tendency of caking coals to cake is increased and this also means that the first must have more frequent attention.

5. One large charge of coal fired by the spreading method will result in a longer

emission of dense smoke than the total emission of such smoke from two charges of half the size fired some time apart and by the alternate method.

6. With some coals, moderate charges fired by the alternate method necessitates less frequent attention to the heater than larger charges fired by the spreading method. Caking coals having a considerable proportion of fine coal or screenings are usually among these. Conversely, a fire will usually require more frequent attention when a lumpy caking coal free from screenings or a non-caking coal is fired in moderate charges by the alternate method.

7. The number of tests made was not large enough to justify conclusions regarding the relative efficiency with which a coal may be burned by the two methods of firing, but the author believes that in actual service over considerable periods better results will be obtained by the alternate method.

8. Frequency of cleaning the fires will be determined by the character of the coal and the rate at which it is burned, but with most coals the fires should be cleaned only once or twice in 24 hours in ordinary weather.

9. If the alternate method of firing is employed, the cleaning should be done before firing the fresh charge, and only one-half of the grate cleaned at a time. Then little or no smoke will result from the cleaning, because the side of the fire on which there is uncoked coal is not disturbed.

10. All three of the coals fired by the alternate method in the tests described were burned at rates corresponding to the heating conditions during the most of the winter, with scarcely any manipulation of the fuel bed except the cleaning of the fires and an occasional leveling just before firing.

11. The average fireman is apt to poke and slice the fire much more than is actually necessary. If a caking coal is used and the caked fuel must be broken up before it is well coked, slice the fire by running a straight bar under the fuel bed and raising it slightly so as to crack the caked mass. Do not stir the bed upside down by raising the bar through the fuel bed, nor break the bed with a bar from the top.

12. If the fuel bed is covered with a charge of fresh fuel in a layer more than 5 in. thick, the new charge, unless it is very free from slack, is apt to have a smothering effect. Then the output of the boiler will be correspondingly decreased and, especially if the spreading method of firing is employed, the mass of fresh coal will usually have to be broken once or twice before the fire will pick up. Consequently, the maximum firing charge should be not much thicker than 5 in. and for caking coals containing considerable slack it should not be more than 4 in. thick. Of course, when a fire is to be kept banked heavier charges may be used.

13. Do not fire large lumps of coal. Break all lumps into pieces no larger than fist size.

14. Large house-heating boilers do not require an intense draft to meet any reasonable demands for heat if the fuel bed is kept in proper condition, but the draft must be properly controlled.

15. The damper regulator should work freely with changes in steam pressure and should close the swinging draft opening in the ash-pit door before it starts to open the check draft in the smoke pipe.

16. The doors on the front of the boiler should fit snugly in their seats; special care should be taken to prevent any material wedging between the doors and the front and thus admitting air when or where it ought to be prevented from entering.

17. Do not allow clinkers to accumulate in the fire or too great a quantity of ashes on the grates. Be careful, however, in shaking the grates not to shake through unburned fuel.

18. In ordinary or severe weather keep an active fuel bed averaging 10 to 12 in. deep. In milder weather the depth of active fuel may be decreased by keeping a layer of ashes on the grate under the live coals.

19. Keep ashes removed from the ash pit.

20. Keep flue surfaces clean by brushing at least once a week.

Copies of this technical paper may be obtained free of charge by addressing the Director of the Bureau of Mines, Washington, D. C.

BULLETIN OF THE NATIONAL DISTRICT HEATING ASSOCIATION for January 15, 1918, contains, as its leading article "Coal Conservation: How We Can Promote It," by Davis S. Boyden, of Boston, in which he gives details of the steps taken in Massachusetts in this connection by the fuel administration. S. Morgan Bushnell writes, in a similar manner, on "Fuel Conservation in Chicago," this being supplemented

by an interesting article on "Indoor Temperatures." Professor J. D. Hoffman contributes a paper on "A Problem in the Adjustment of Steam Heating Rates," in which he analyzes a specific case and reaches the conclusion that, in the case, which is fairly typical, a reasonable charge would be 60 cents per 1000 lbs. of steam delivered. This is based on an average coal cost of $4.50 per ton delivered. Seven pages are given over at the back of the *Bulletin* to a compilation, made by the American District Steam Company, of North Tonawanda, N. Y., of present and former steam heating rates in 36 cities.

ENGINE GUARDING AND ENGINE STOPS is the title of one of the latest publications of the National Safety Council, Chicago, Ill. After taking up construction suggestions for engine rooms, the pamphlet discusses guards on engines, some simple governor stops, independent safety-stops and their care, some home-made safety-stops, automatic vacuum-breakers, automatic circuit breakers, inspection of fly-wheels, governors, etc. The pamphlet concludes with notes on engine operation and a set of well-compiled engine-room rules. Pp. 16. Price 10 cents.

NEW DEVICES

A Portable Electric Nitrogen Radiator.

An unusual type of electric radiator has been brought out by the Willis Mfg. Co., Cleveland, O., and is known as the Willis electric nitrogen radiator. The radiator looks like the ordinary pressed steel radiator only smaller in size and is filled with nitrogen gas. It is stated that its heating capacity, size for size, is more than 100° hotter than a steam radiator and between 150° and 200° hotter than the usual hot-water radiator. It maintains an average temperature of 350° F. The radiator is made 14 in. high, 4¾ in. wide, with from four to ten sections. In its construction the electric heating element is surrounded by nitrogen gas. The gas fills the entire inside of the radiator which is hermetically sealed. Attention is called to the fact that nitrogen cannot burn or explode as it is an inert and non-oxidizing gas. While

WILLIS PORTABLE ELECTRIC NITROGEN RADIATOR.

carried under a slight pressure, tests have shown that at no time will it reach more than one-quarter the tested pressure of the radiator.

Regarding cost of operation, for a 4-section radiator, containing 4 sq. ft., the consumption is estimated at 400 watts per hour, amounting to 2 cents, based on a rate of 5 cents per Kw. Hr.

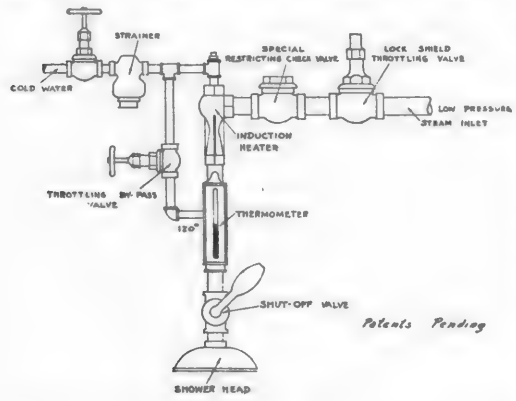
Willis radiators are designed for use on any electric current of proper voltage. The standard radiators are built for 110 volts, although the prices are the same for 220 volts. The prices range from $12.00 for a 4-section radiator to $25.00 for a 10-section unit.

Even Heat Shower and Hot Water Supply.

An arrangement for supplying hot water at any temperature desired up to 180° F. and maintaining an even temperature during use, has been designed by James A. Donnelly, New York, and is being placed on the market by the Donnelly Systems Co., New York. No tank or coil is required with this system, or thermostat for controlling the temperature. Exhaust steam is utilized from any source, or low-pressure live steam. The device is entirely automatic in its operation.

In starting the system the hot water

faucet is opened, draining the pipe from the induction heater. The temperature of the water is determined by the restricting effect of the special check valve and the setting of the lock-shield throttling valve. After this is done, if the pressure of water



DEVICE FOR SUPPLYING HOT WATER AT EVEN TEMPERATURE.

and steam used are substantially constant, there will be no appreciable variation in the temperature of the water delivered.

When used for a shower bath, an individual cold water pipe is run from the supply tank to each shower. The shut-off valve immediately above the shower head is opened and the maximum temperature of water (110°) will then be delivered. When the temperature is to be reduced, the throttling by-pass valve is used. The valve controls the temperature of the water issuing from the shower head, regardless of the operation of adjoining showers or other water fixtures.

Trade Literature.

RECUPERATIVE GAS-OVEN FURNACES, for accurate temperature work in hardening carbon steel, preheating and reheating high-speed steels, annealing, hardening, etc., are described and fully illustrated in a recent bulletin (No. 160) issued by Tate-Jones & Co., Inc., Pittsburgh, Pa.

WESTINGHOUSE INDUSTRIAL HEATING APPARATUS, including electric air heaters for heating residences or other buildings, and electrically-heated ovens, such as enameling ovens, are the subject of a new catalogue (No. 8-E) sent out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The catalogue is supplemented with data on the electrical energy required for heating buildings, based on the formula:

$$\left(\frac{W}{4} + G + \frac{C}{55}\right)\frac{T}{3.4} = \text{heat losses in watts.}$$

This formula, it is stated, is to be used with judgment. The watts lost by radiation per square foot of surface per degree difference are given as follows:

Radiation Surface	Watts
24-in. brick wall	0.0575
12-in. brick wall	0.0925
8-in. brick wall	0.1350
4-in. brick wall	0.1930
Wooden flooring	0.0245
Wooden ceiling	0.0305
Fireproof flooring	0.0360
Fireproof ceiling	0.0425
Single window	0.355
Single skylight	0.300
Double window	0.170
Double skylight	0.185
Door (65% wood—35% glass)	0.170
Door-plain	0.120
Wood partition—1-in. thick	0.120

POCKET CO_2 INDICATOR, American type, described as the only practical CO_2 analyzer, always ready for use, compact and rugged, has been brought out by the Bacharach Industrial Instrument Co., Pittsburgh, Pa., and is described in a newly-issued circular. The circular contains a chart, reproduced herewith, showing that for coal-fired furnaces, about 40% of excess air is necessary to obtain the most efficient combustion. This is indicated by the highest CO_2 content obtained by this amount of air, as shown by the two curves. A greater percentage of excess air reduces the CO_2

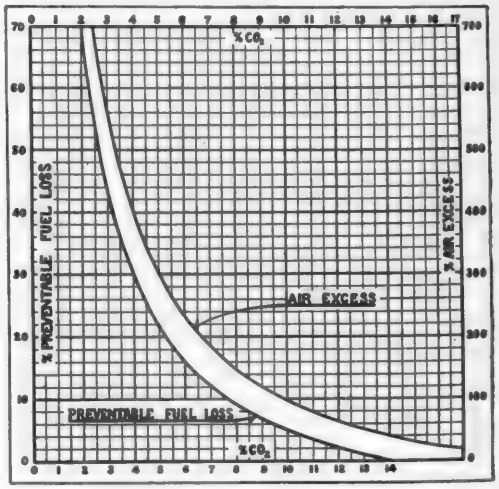
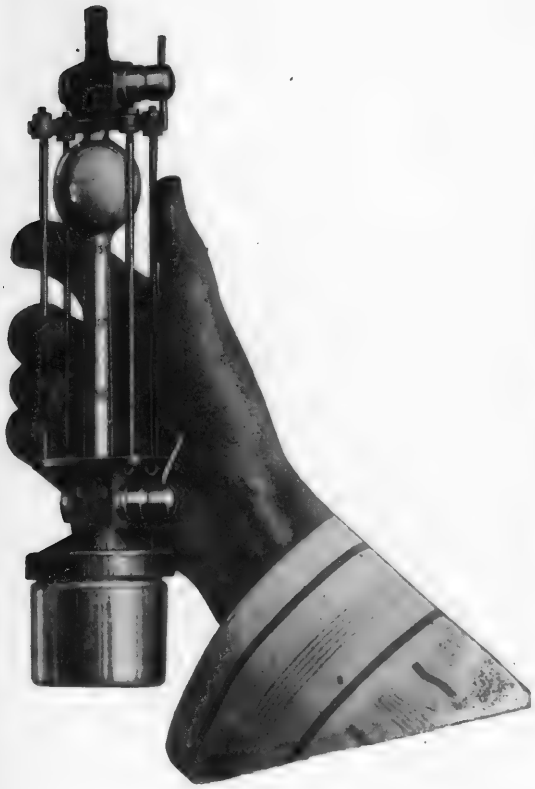


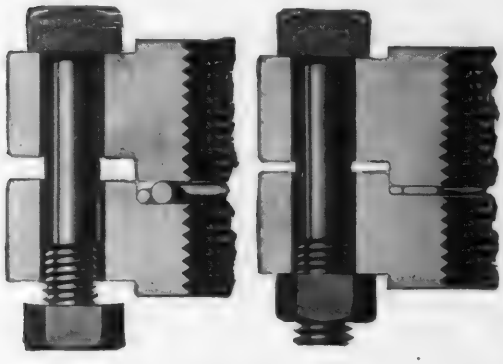
CHART SHOWING EXCESS AIR REQUIRED FOR MOST EFFICIENT COMBUSTION IN FURNACES.



POCKET CO_2 INDICATOR

contents and therefore increases the fuel loss. Thus, for 300% excess air, the CO_2 drops to 5%, while the corresponding fuel loss becomes 21%. The new pocket CO_2 indicator is intended to replace the Orsat apparatus. It is stated that a test takes about 2½ min. and that one may go from one furnace to another and make tests with this device at the rate of twenty or more per hour. The circular contains full directions for use, accompanied by illustrations.

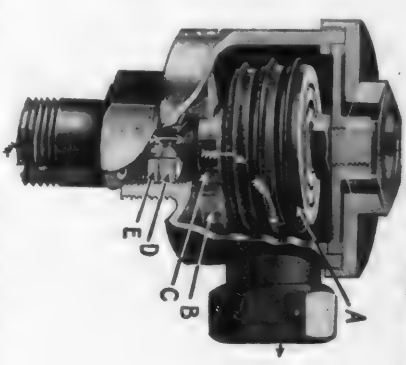
SARCO MERWATH METALLIC GASKET, is a new product brought out by the Sarco Co., Inc., New York, and presented in new circular matter. The gaskets are described as plastic and yet resilient. They do not become easily distorted so that they are not likely to be dstroyed when the joint is broken. The lead lying within the copper ring is retained in place and is designed to fill every unevenness in the surface of the joint. It is also pointed out that extreme pressure is not required to make the joint, and expansion strains are easily taken up without leakage. The gasket is made of hard copper and owing to the elasticity of this metal, it is stated that the gaskets do not deteriorate in service and that the joints made with them may be made and broken repeatedly. The gasket is made in four types, the non-corrosive type, a type for union connections



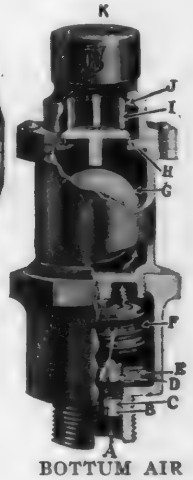
SECTIONAL VIEW OF SARCO GASKET BEFORE AND AFTER JOINT IS TIGHTENED.

where the coupling surfaces to be sealed are relatively narrow, a type with centering ring for flange connections and a copper type for superheated steam. These types are all illustrated in colors and their uses explained.

VAPOR VACUUM HEATING, featuring the latest type of the Bottum thermostatic radiator trap, is discussed in a new catalogue published by the Bottum Valve Co., Chicago, Ill. Two new features have recently been added to this trap, one which makes it adjustable and the other consisting of a guide to conduct the disc in a straight line to its seat. The bodies of



BOTTUM THERMOSTATIC RADIATOR TRAP.



BOTTUM AIR ELIMINATOR

the traps are made of red brass, and are given a nickel finish. The Expansion members are filled with a low-expanding chemical fluid while under a vacuum. This gives them a percentage of expansion under various temperature conditions. It is stated that they will allow a small or large volume of water to pass with equal facility. These traps are especially adapted to installations where a pump is used, as the expansion members are entirely filled with the chemical. The catalogue also gives special prominence to the Bottum air eliminator which is designed to allow the air from a vapor heating system to escape but not the vapor or water. This device is built on original lines, its construction being illustrated and described in detail. Size 5x8 in. Pp. 16.

YOU CAN SAVE COAL is the title of a circular devoted to the Syracuse packless valve, manufactured by the Syracuse Faucet & Valve Co., whose headquarters are now located at 101 Park Ave., New York, with E. F. Glore in charge. The circular explains how the construction of the Syracuse valve eliminates the danger of leaks at this point, the stem steam seat preventing any steam or water getting out of the valve, so that the valve never has to be packed.

HEATING DUCTS FOR FACTORY BUILDINGS, as well as for schools, theatres, hotels, churches, etc., made of Pyrobar tile and Structolite, are the subject of a new circular issued by the United States Gypsum Co., Chicago, Ill. The illustrations show the use of this material for constructing the ventilating ducts for the Saxon Motor Company's new factory in Detroit. Pyrobar is a smooth-side partition tile and is made in all sizes, with faces 12 in. x 30 in., while gypsum which is used in this tiling, is well-known as an insular. Structolite, from which this tiling is moulded, is a specially-prepared gypsum product and is for use for wide ducts, difficult bends, etc., as it can be poured in place and reinforced as required.

CONDENSATION UTILITIES, containing 22 prints of types of systems which the Farnsworth line of apparatus is capable of handling, is the title of a newly-published catalogue received from the Farnsworth Co., Conshohocken, Pa. Twelve types of machines are shown for handling condensation under almost any known condition, feeding it directly into the boiler under a closed or open system. The manufacturers state that with their large variety of improved machines they are collecting condensation and feeding it into boilers, in numerous instances, at 300° F.,

FOURTEEN 600-H.P. FARNSWORTH MACHINES SHIPPED ON ONE ORDER.

where previously the condensation had been allowed to flow to the sewer. The importance of this may be realized when it is stated that about 3300 lbs. of water is pumped into the average boiler for every 100 H.P. Most of the sketches shown were made as a direct result of visits to plants where conditions were found that required attention. All of the systems and the several types of machines listed in the catalogue originated and were designed by F. C. Farnsworth. Size 10 x 4 in. Pp. 16+24 sheets. Bound in loose-leaf form.

Daylight Saving Bill Before Congress.

The severity of the present winter, in most sections of the country has given an impetus to the agitation in favor of the passage of the daylight saving bill, now pending in Congress. Twelve European countries, including England, France, Germany, Austria-Hungary and Italy have adopted this plan, as has also Australia. As is well-known, the plan proposed in the bill is to turn the hands of the clock ahead one hour.

Current Heating and Ventilating Literature

Under this heading is published each month an index to the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

GAS FIRING

Gas Firing Boilers. T. M. Hunter. 15500 w. Instn E E—Oct. 1917. Study of the subject. Price on application.

Gas-Firing Boilers. T. M. Hunter. 3000 w. Elec'n—Nov. 23, 1917. Serial, 1st part. Abstract of paper before Instn. of Elec. Engrs. Drying and cleaning gas, heat transfer, types of boilers, etc. 40c.

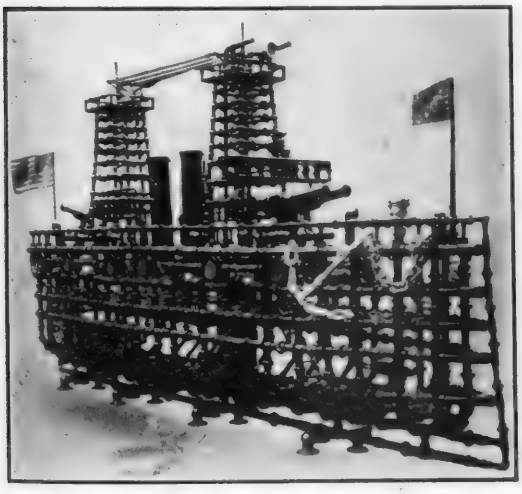
HEAT TRANSFER

Heat Transfer from Air to Pipes. Charles H. Herter, with discussion. Ills. 6000 w. A S R E, Jl—Nov., 1917. Investigations of heat transfer problems. 60c.

The Transfer of Heat Between a Flowing Gas and a Containing Flue. Lawford H. Fry. 32 pp. A S M E—Dec., 1917. Formula with description. 40c.

Model Battleship Made of Pipe Fittings.

A unique piece of pipe fitting, representing a model of the battleship New York, has been constructed in the Bridgeport shops of Crane Company by Julius Gerion, one of the company's mechanics. It is made entirely of articles manufactured by Crane Co. There are 6,669 separate pieces in the model, including 47 different types of pipe fittings, four different types of valves, brass whistle, oil cup and valve parts. In the hold are located the boiler and engines, with necessary steam piping. A ⅛-H.P. electric motor is included which operates a propeller shaft made from a gate valve spindle, while the propeller itself is made of galvanized pipe fittings. There is also a wireless installation, the aerial being made of ⅛-in. pipes suspended between the two masts.



MODEL BATTLESHIP MADE OF 6,669 SEPARATE PIECES OF PIPE AND FITTINGS.

The over-all length of the model is 186 in. and the total height from keel to top-mast is 102 in. The net weight is 3,308 lbs.

Deaths.

CHARLES B. THOMPSON, president of the Thompson Heater Corporation, Buffalo, N. Y., and formerly manager of the Department of Research of the American Radiator Company, died at his home in Tonawanda, January 10. Mr. Thompson was ill but a few days, his death being caused by pneumonia. He was an old-time figure in the heating trade. After conducting a small heating, tinsmithing and plumbing business in Canada, he went to Boston in 1888 and became connected with the National Hot Water Heater Co. He was made manager of the firm's Chicago branch and when this firm was absorbed by the Ideal Boiler Company, he engaged in the heating contracting business in Chicago. About ten years later he joined the ranks of the American Radiator Company as manager of the company's research department in Buffalo. He formed the Thompson Heater Corporation about one year ago and was the designer of the Thompson heater placed on the market by this firm. He is survived by a widow and one son.

E. B. BADGER, founder of E. B. Badger & Sons Co., Boston, Mass., manufacturers of copper tanks, boilers and expansion joints, died at his home in that city, January 15. He was 89 years old. Mr. Badger was a native of Boston and had always lived there. When a young man he was apprenticed to a coppersmith and later became foreman of the establishment. He was afterwards taken into partnership. Some years later he formed the firm of E. B. Badger & Sons Company, which was originally a coppersmithing business. He held the office of president of the company until his retirement, about eight years ago. He is survived by seven sons, two of whom are officers of the company.

Standard Heating and Ventilating Data Sheets.

As the data sheets appearing from month to month in THE HEATING AND VENTILATING MAGAZINE increase in number, it is apparent that a listing of them in numerical order, rather than by the issues in which they appear, will simplify reference to previously-published sheets, as well as give some indication of those still to come. Some of the subjects, such as B.T.U. losses, and air changes, are complete. The series on chimneys, also, is now complete. The data sheets on ducts and flues and on radiators will include many sheets in addition to those published.

Attention has already been called to the fact that the sheets will not always appear in consecutive order. The reason for this will be understood by referring to the following table. For instance, on the subject of chimneys, this appears last on the completed list but as it formed a timely topic for presentation, it was run in ahead of other sheets. Similarly, in the matter of radiator data, in order to avoid the monotony of publishing a large number of sheets more or less similar, one or more will appear each month, accompanying data sheets on other subjects.

Extra copies of any of the data sheets, printed on one side only, may be had at 5 cents each, or $2.00 for a year's supply of 48 sheets.

No.	Date Issued		Subject
			B.T.U. Losses
1	Feb.,	1917	General.
1-A	"	"	Brick.
1-B	"	"	Stone and Concrete.
1-C	"	"	Combinations.
1-D	March,	"	Tile.
1-E	"	"	Frame Construction.
1-F	"	"	Glass, Skylight and Miscellaneous.
1-G	"	"	Ceiling, Floor and Roof.
			Exposure
2	April,	1917	General.
			Leakage
3	April,	1917	General.
			Temperature Range
4	April,	1917	Minimum Temperatures in U. S.
4-A	"	"	Minimum Temperatures in U. S. (continued).
			Computing Heat Losses
5	May,	1917	General.
5-A	"	"	Example.
			Ventilation
7	May,	1917	General.
			Air Changes
8	May,	1917	Churches and Theatres.
8-A	June,	"	Hospitals.
8-B	"	"	Hotels and Libraries.
8-C	"	"	Schools.
8-A	"	"	Miscellaneous.
			Properties of Air
9	July,	1917	Table.
			Ducts and Flues
10	July,	1917	General.
10-A	"	"	Elbows.
10-B	"	"	Anemometer Readings.
10-C	August.,	"	Underwriters' Rules.
10-D	"	"	Underwriters' Rules (continued).
10-E	"	"	Underwriters' Rules (continued).
10-F	"	"	Velocities Recommended.
10-G	Sept.,	"	Vent Flue Velocities.
10-H	"	"	Areas of Pipes.
10-I	"	"	Areas of Pipes (continued).
10-J	"	"	Pipe Capacities at Various Velocities.
			Duct and Flue Details
11-A	Feb.,	1918	Flue Outlets and Dampers.
11-B	"	"	Details of Reversing Dampers.
			Radiation
13	Jan.,	1918	Radiation Computing.
13-A	"	"	Radiation Efficiencies.
13-C	"	"	Radiation Computing — Example.
			Radiators
14-A	Jan.	1918	Radiators — American Rococo. 1-Col.
14-B	Feb.,	"	Radiators — American Rococo. 2-Col.
14-C	"	"	Radiators — American Rococo. 3-Col.
			Chimneys
100	Oct.,	1917	General.
100-A	"	"	Residence.
100-B	"	"	Residence (continued).
100-C	"	"	Coal and Air per B.H.P.
100-D	Nov.,	"	Draft Loss in Fire and Boiler.
100-E	"		Draft, Theoretical and Effectual.
100-F	"	"	Draft, Theoretical, of Stacks.
100-G	"	"	Friction Losses in Steel Stacks.
100-H	Dec.,	"	Friction Losses in Brick Stacks.
100-I	"	"	Summary and Draft Reading.
100-J	"	"	Example of Computation.
100-K	"	"	Costs.

Preventable Fire Causes in the United States.

In a bulletin published by the National Board of Fire Underwriters on "Safeguarding America Against Fire," the strictly preventable fire causes are given as totaling $60,466,054. Of this amount defective chimneys and flues came to $12,724,317; stoves, furnaces, boilers and their pipes to $11,204,875; gas, natural and artificial, $1,815,597. The partly preventable fire causes came to $99,606,293, consisting of those due to exposure, electricity, explosions, spontaneous combustion, incendiarism, lightning, sparks from machinery, sparks from combustion and miscellaneous. The unknown fire causes amounted to $48,632,993.

Weight of Round Galvanized Iron Pipe and Elbows

OF THE PROPER GAUGES FOR BLAST-PIPE SYSTEMS

Diameter of Pipe in Inches	Gauge of Iron	Weight per Running Foot in Pounds	Actual Weight of Full Elbow	Diameter of Pipe in nc hes	Gauge of Iron	Weight per Running Foot in Pounds	Actual Weight of Full Elbow
3	25	0.9	0.6	38	18	23.7	179.8
4	25	1.3	1.1	39	18	24.3	189.4
5	25	1.6	1.6	40	18	24.9	199.2
6	25	1.9	2.3	41	16	31.5	258.4
7	25	2.1	3.0	42	16	32.2	270.7
8	25	2.4	3.9	43	16	32.9	283.3
9	25	2.7	4.9	44	16	33.7	296.2
10	25	3.0	6.0	45	16	34.5	310.3
11	24	3.7	8.2	46	16	35.2	323.8
12	24	4.1	9.8	47	16	35.9	337.6
13	24	4.4	11.4	48	16	36.7	352.6
14	24	4.7	13.2	49	16	37.4	367.0
15	24	5.0	15.1	50	16	38.2	381.6
16	24	5.4	17.1	51	16	39.0	397.6
17	22	6.9	23.5	52	16	39.7	412.8
18	22	7.3	26.3	53	16	40.5	430.5
19	22	7.7	29.3	54	16	41.4	447.5
20	22	8.2	32.8	55	16	42.3	464.8
21	22	8.5	35.9	56	16	43.0	481.3
22	22	8.9	39.3	57	16	43.8	499.2
23	20	11.0	50.7	58	16	44.5	516.2
24	20	11.5	55.1	59	16	45.3	533.6
25	20	12.0	59.9	60	16	46.0	552.5
26	20	12.4	64.3	61	14	57.5	701.5
27	20	12.9	69.9	62	14	58.4	724.2
28	20	13.4	75.2	63	14	59.3	747.2
29	20	13.9	80.6	64	14	60.3	771.8
30	20	14.4	86.3	65	14	61.2	795.6
31	20	14.9	92.4	66	14	62.2	821.4
32	18	20.0	127.4	67	14	63.0	844.2
33	18	20.6	135.8	68	14	64.0	870.4
34	18	21.2	144.2	69	14	65.0	897.0
35	18	21.8	152.7	70	14	66.0	924.0
36	18	22.4	161.5	71	14	67.0	951.4
37	18	23.0	170.5	72	14	67.9	977.5

The weights as given include the weight of rivets and solder, and due allowance has been made for laps and trimmings. The elbows have the internal radius equal to the diamter of the pipe. Rectangular pipes are usually made of the same gauge as round pipes of equivalent area.

Note—Square pipes will weigh about 27 per cent more than round pipes whose diameter is the same as the side of the square pipe. (From B. F. Sturtevant Co.)

FOR REDUCING THE WEIGHT OF GALVANIZED IRON PIPE OF ONE GAUGE TO THAT OF ANOTHER GAUGE

Gauge.	GAUGE AND WEIGHT IN POUNDS PER SQUARE FOOT.																
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	4.53	3.91	3.28	2.97	2.66	2.41	2.16	1.90	1.66	1.53	1.41	1.28	1.16	1.03	0.91	0.84	0.78
12	1.00	0.86	0.72	0.66	0.59	0.53	0.48	0.42	0.37	0.34	0.31	0.28	0.26	0.23	0.20	0.19	0.17
13	1.16	1.00	0.84	0.76	0.68	0.62	0.55	0.49	0.43	0.39	0.36	0.33	0.30	0.26	0.23	0.22	0.20
14	1.38	1.19	1.00	0.91	0.81	0.74	0.66	0.58	0.51	0.47	0.43	0.39	0.35	0.32	0.28	0.26	0.24
15	1.53	1.32	1.10	1.00	0.90	0.81	0.73	0.64	0.56	0.52	0.48	0.43	0.39	0.35	0.31	0.28	0.27
16	1.70	1.47	1.23	1.11	1.00	0.91	0.81	0.71	0.62	0.58	0.53	0.48	0.44	0.39	0.34	0.32	0.29
17	1.88	1.62	1.36	1.23	1.10	1.00	0.90	0.79	0.69	0.63	0.59	0.53	0.48	0.43	0.38	0.35	0.32
18	2.10	1.81	1.52	1.38	1.23	1.12	1.00	0.88	0.77	0.71	0.65	0.59	0.54	0.48	0.42	0.39	0.36
19	2.38	2.06	1.73	1.56	1.40	1.27	1.14	1.00	0.87	0.81	0.74	0.67	0.61	0.54	0.48	0.44	0.41
20	2.72	2.36	1.98	1.79	1.60	1.45	1.30	1.16	1.00	0.92	0.85	0.77	0.70	0.62	0.55	0.51	0.47
21	2.96	2.56	2.14	1.94	1.74	1.57	1.41	1.24	1.09	1.00	0.92	0.84	0.76	0.67	0.59	0.55	0.51
22	3.21	2.77	2.32	2.10	1.89	1.71	1.53	1.35	1.18	1.08	1.00	0.91	0.82	0.73	0.65	0.60	0.55
23	3.54	3.07	2.56	2.32	2.08	1.88	1.69	1.49	1.30	1.20	1.10	1.00	0.91	0.81	0.72	0.66	0.61
24	3.90	3.37	2.82	2.56	2.29	2.08	1.86	1.61	1.43	1.32	1.22	1.10	1.00	0.89	0.78	0.72	0.67
25	4.40	3.79	3.18	2.88	2.58	2.34	2.10	1.86	1.61	1.49	1.37	1.24	1.12	1.00	0.88	0.82	0.76
26	4.98	4.30	3.60	3.26	2.92	2.65	2.37	2.10	1.82	1.68	1.55	1.41	1.27	1.13	1.00	0.92	0.86
27	5.40	4.66	3.90	3.54	3.17	2.87	2.57	2.28	1.96	1.82	1.68	1.52	1.38	1.23	1.08	1.00	0.93
28	5.81	5.01	4.20	3.80	3.41	3.09	2.77	2.45	2.13	1.96	1.81	1.64	1.49	1.32	1.17	1.08	1.00

The table above serves for the estimation of weights of pipe of gauges other than those given on Standard Data Sheet No. 169-E. Thus, suppose it is desired to find the weight of 28-in. pipe made of No. 16 gauge. From the 169-E table, pipe of this size made of No. 20 gauge weighs 13.4 lbs. per running foot. By the table above, the figure found at the junction of the column headed **16** and the line designated **20** is 1.60; therefore, the weight per foot of No. 16 gauge is $13.4 \times 1.60 = 21.44$ lbs.

(From B. F. Sturtevant Co.)

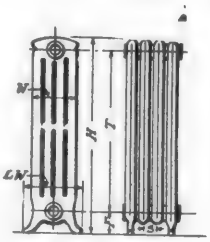
STANDARD HEATING AND VENTILATING SYMBOLS

While there are many symbols in use in various parts of the country and even by different designers in the same sections, the symbols shown below are the ones most closely approximated by a majority of the largest and most responsible firms engaged in such work. It is hardly necessary to point out the desirability of universally using the same symbols throughout the country and it is believed that the following are clear, practical and easy to make and read.

T	Thermostat		High Pressure Steam
H-1	First Floor Supply		High Pressure Drip
E-2	Second Floor Exh.		Low Pressure Steam
PH	Pipe Hanger		Low Pressure Return
PA	Pipe Anchor		Low Pressure Drip
	Expansion Joint		Trap Discharge.
	Elbow-Looking Dn.	2-38-10 40	Column Radiator - Plan
	Elbow-Looking Up	40	Column Radiator - Elev.
	Tee - Looking Dn.	10T-C.I.	Wall Radiator - Plan
	Tee - Looking Up		Wall Radiator - Elev.
	U Pipe Coil		Pipe Coil - Plan.
FD	Damper		Pipe Coil - Elev.
	Toilet Exhaust		Supply Duct or Flue
	Kitchen Exhaust		Exhaust Duct or Flue
	Vento - Plan		Supply Register.
	Vento - Elevation		Exhaust Register.
A.V.	Auto. Air Valve		Trap
	Check Valve		Gate Valve
	Diaphragm Valve		Globe Valve
	Angle Valve		Water Seal or Thermo. Trap
	Safety Valve		Reducing Valve.
W.H.H.	Hot Water Heater		Piston Pump
R - R.F.	Register or Reg. Face		Fan
T.G. - B.G.	Top or Bottom Grille		Motor
	Air Washer		Engine

AMERICAN RADIATOR COMPANY'S ROCOCO FOUR-COLUMN RADIATORS FOR STEAM AND WATER

No. of Sections	Length 3 in. per Sec.	Heating Surface — Square Feet: 45-in. Height 10 sq. ft. per Sec.	38-in. Height 8 sq. ft. per Sec.	32-in. Height 6½ sq. ft. per Sec.	26-in. Height 5 sq. ft. per Sec.	22-in. Height 4 sq. ft. per Sec.	18-in. Height 3 sq. ft. per Sec.
2	6	20	16	13	10	8	6
3	9	30	24	19½	15	12	9
4	12	40	32	26	20	16	12
5	15	50	40	32½	25	20	15
6	18	60	48	39	30	24	18
7	21	70	56	45½	35	28	21
8	24	80	64	52	40	32	24
9	27	90	72	58½	45	36	27
10	30	100	80	65	50	40	30
11	33	110	88	71½	55	44	33
12	36	120	96	78	60	48	36
13	39	130	104	84½	65	52	39
14	42	140	112	91	70	56	42
15	45	150	120	97½	75	60	45
16	48	160	128	104	80	64	48
17	51	170	136	110½	85	68	51
18	54	180	144	117	90	72	54
19	57	190	152	123½	95	76	57
20	60	200	160	130	100	80	60
21	63	210	168	136½	105	84	63
22	66	220	176	143	110	88	66
23	69	230	184	149½	115	92	69
24	72	240	192	156	120	96	72
25	75	250	200	162½	125	100	75
26	78	260	208	169	130	104	78
27	81	270	216	175½	135	108	81
28	84	280	224	182	140	112	84
29	87	290	232	188½	145	116	87
30	90	300	240	195	150	120	90
31	93	310	248	201½	155	124	93
32	96	320	256	208	160	128	96



Connections: Both WATER and STEAM—Extra-heavy right and left-threaded nipples at top and bottom.
* Add ½ in. to length for each bushing.

DIMENSIONS

H = Total overall height.
T = C. to C. of tappings on water radiators.
F = Floor to center of bottom tapping.
W = Width of radiator—10½ in.
LW = Width of radiator legs—11¼ in.
S = Width of radiator sections—*i.e.*, c. to c. of sections or 3 in.

Nominal Height of Radiator	45-in.	38-in.	32-in.	26-in.	22-in.	18-in.
H	46	38 5/16	32 7/16	26 11/16	22 11/32	18 5/16
T	38 25/32	31 3/32	25 13/64	19 15/32	15 7/32	11 3/16

Note: For legless radiators deduct 3 in. from H.
For high legs add 2 in. and for extra high legs add 4 in. to H and F.
High legs on these radiators are special.

TAPPING DATA

All radiators are tapped 2 in. and bushed as follows:

SYSTEM	Size of Radiator, Square Feet	Supply In. Diam.	Supply F In.	Return In. Diam.	Return F In.
Steam, one-pipe	Up to 24 inc.	1	4	..	..
	Over 24 up to 60 inc.	1¼	4	..	..
	Over 60 up to 100 inc.	1½	4	..	..
Steam, two-pipe	Up to 48 inc.	1	4½	¾	4
	Over 48 up to 96 inc.	1¼	4½	1	4
	Over 96	1½	4½	1¼	4
Water	Up to 40 inc.	1	4	1	4
	Over 40 up to 72 inc.	1¼	4	1¼	4
	Over 72	1½	4	1½	4

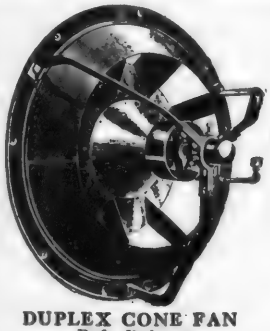
Air valve tappings are ⅜ in.
Vapor tappings, top and bottom, opposite ends ¾ in. supply and ½ in. return.
All tappings with right-hand threads unless otherwise ordered.

TRADE AND MISCELLANEOUS NOTES

Trade and Miscellaneous Notes.

Camp Grant, Ill.—How the edict of the fuel administrator was acted upon at one of the great army cantonments is told in a dispatch from Camp Grant, Ill. The edict, of course, did not affect the camps but in an effort to co-operate with the spirit of the government order for the conservation of fuel, there were lightless nights and waterless periods, in addition to a strict supervision of the steam heating of the buildings. It was further planned to reduce the temperature of the barrack buildings between 8° and 10°, with an estimated saving of nearly 2000 tons of coal per month. During December Camp Grant, which is probably typical, used 19,500 tons of run-of-mine coal; 12,000 tons were used by the fifteen heating plants, 7,000 tons were used in the kitchens, bakery and refrigerating plant and 500 tons in small isolated stove- and furnace-heated buildings and for water-heating apparatus. The camp was to receive during the remaining four winter months 400 cars per month, under contract. A surplus of 25,000 tons is carried on hand. Captain George Heise, in charge of the chemical and physical laboratories of the utilities division, is conducting the heat economy campaign and is formulating plans for a substantial reduction in the 650-ton daily fuel consumption for all purposes in the camp. The use of 7000 tons of coal by the cooks in the kitchens is believed to be excessive. This, and other savings, are estimated at 5000 tons per month.

Des Moines, Ia.—"I have never seen quite so many defective boiler settings in my life as during my Des Moines survey," said Royal H. Holbrook, who has been inspecting the boiler rooms in Iowa to conserve fuel. "It seems to me that every place I went the brick walls surrounding a



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45 FULTON ST., N. Y.
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MANUFACTURERS OF
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which are installed by us complete with **Motors, Duct Work** and **Wiring**.

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.
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Direct Connected to Motor

boiler were badly broken and showed bad workmanship on the part of the bricklayer." For stopping up the cracks in the boiler settings Mr. Holbrook recommends the following:

Take 10 lbs. of Trinidad asphalt and heat it until it will run like paint. Remove it from the fire a long way from a building and in the open air and stir into it 1 gal. of benzine or naphtha. While the asphalt is being melted take 7 lbs. of Portland cement and 8 lbs. of asbestos-magnesia, thoroughly mix together and dry them in an oven at a temperature of at least 300° F., after which thoroughly mix all of the materials together, when it will be ready to apply with a brush to the brick walls of a boiler. Put on several coats, letting each one dry completely. Being of an asphalt basis, the whole mixture will contract and expand evenly, at the same time remaining quite plastic under heat.

Columbus, O.—If an extra session of the legislature is called this year the state board of administration is planning to make a determined effort to obtain a liberal appropriation for installing new heating plants and repairing old ones at the various State institutions under its management. Data are being prepared which will show that thousands of dollars may be saved annually on the fuel bills if the heating plants were brought up-to-date. To do this will require at least $250,000.

"Shovel Tag Day," was observed throughout the United States on January 30, when 21,000,000 school children made a house-to-house canvass tagging coal shovels with notices to "Save Coal and Win the War." The tags also bear the following notes:

"Save that shovelful of coal a day for Uncle Sam.

"Cover furnaces and pipes with asbestos or other insulation; also weather-strip your windows or stuff cracks with cotton.

"Keep your rooms at 68° (the best heat for health).

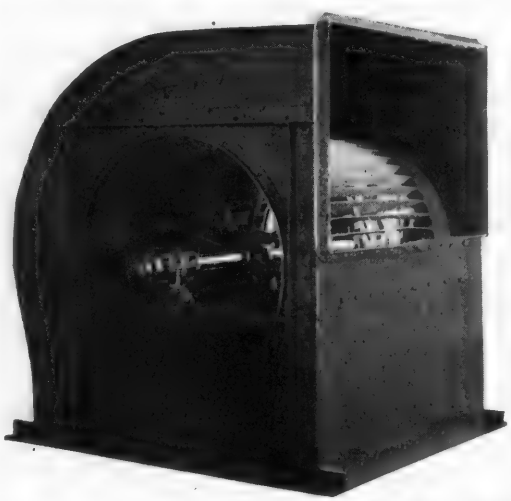
"Heat only the rooms you use all the time.

"Test your ashes by sifting. If you find much good coal, there is something wrong with your heater. See a furnace expert.

"Write to the maker of your furnace or stove for practical directions for running economically.

"Save gas and electric light as much as

Watch for Our Announcement



in the April Issue
of our

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Karstens Engineering Sales Co.
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Detroit, Mich.

possible—this will save coal for the nation.

"The fuel administration points out that this tag day is different from all other tag days. Instead of asking for cash contributions, the school children will demand that householders save money—for food, for war-saving stamps, for Liberty bonds and, at the same time, add to the government's coal pile."

Ames, Ia.—"How to Save Coal in Your House Furnace," is treated in a series of illustrated suggestions published by the Engineering Extension Department of the Iowa State College in Ames.

Department of Education, New York, states that owing to a recent fire which destroyed the records and files of the Building Bureau of the New York City Board of Education, catalogues of all building trades manufacturers and shop tools are needed by the engineers of the board. Manufacturers will confer a favor by forwarding complete catalogues and data sheets to F. G. McGann, Room 1827 Municipal Building, New York.

Detroit, Mich.—Following laboratory tests and experiments made at the Duane Doty School, the local board of health has tendered a report to the board of education endorsing the proposed plan of exhausting air from the classrooms through the wardrobes. The investigation conducted by the health department showed that the air in a well-kept wardrobe contained fewer dust particles per cubic foot than did the classroom. Children's garments hanging in a wardrobe, the report states, are as safe from dangerous dust as they would be if hanging at home and considerably safer than when worn on the street. Danger of the transmission of communicable disease germs, it is pointed out, is far greater in crowded, dusty, ill-ventilated places. The report mentions the methods employed in the hospital of the Pasteur Institute, in Paris, and other contagious-disease hospitals where patients are placed in rooms opening onto a common hall where there is no apprehension felt over the possibility of aerial transmission of germs. This method has been in use in the schools of New York City since 1892, while St. Louis and Cleveland are designing schools along the lines proposed.

Building Permits for the year of 1917, showed a decrease of 29%, covering those issued in 102 principal American cities. The list as compiled by the *American Contractor,* Chicago, states that 205,667 permits with a total valuation of $648,678,804 were issued during 1917, as compared with 266,049 permits, with a total valuation of $854,920,723 issued during 1916. For the final month of December, 1917, 109 cities reported permits valued at $29,196,350, as compared with $68,043,869 in 1916, a decrease of 57%. Among the more important losses were the following: Boston 68%, Chicago 45%, Cleveland 55%, Cincinnati 45%, Detroit 72%, New York 46%, Minneapolis 88%, Philadelphia 86%, Pittsburgh 57%, San Francisco 65%, and Washington 55%. The only large cities reporting gains were Atlanta 22% East Orange 135%, Erie 36%, Fort Wayne 7%, San Antonio 20%, Schenectady 87%, Spokane 420%, and Syracuse 53%.

Chicago, Ill.—Acting on an order from Dr. Garfield, the Illinois Fuel Administration began work February 12 on a plan to withhold coal from Illinois industries in the non-preferred class. With the daily normal consumption in the State estimated at 200,000 tons, the daily production at 100,000 tons and no reserve on hand, it was pointed out that something would have to be done quickly to tide consumers over the crisis. At a meeting of the State Council of Defense it was decided to appoint a committee in whose hands should be placed the power of deciding which industries shall receive coal and which shall not. The committee will deal with individual cases and will take into consideration the amount of coal on hand and other factors.

Milwaukee, Wis.—Wisconsin Association of Master Steam and Hot water Fitters held its annual meeting in Milwaukee,

STANDARD THERMOMETERS - Indicating and Recording

for VACUUM, STEAM and HOT WATER SYSTEMS, BAKE OVENS and COLD STORAGE PLANTS. SEVEN models of RECORDING and EIGHT of INDICATING Thermometers. All Accurate, Durable and Legible.

Backed by thirty years of Thermometer manufacturing.

They are practically indestructible, are sensitive to changing temperatures and are very easily installed. Supplied with horizontal or vertical extension and standard pipe thread.

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STANDARD THERMOMETER COMPANY, 65 Shirley St., Boston, Mass.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

January 14. Sixty members were present in spite of the severity of the weather, an unusual snow storm being accompanied by low temperatures. Officers were elected as follows: President, Frank Meadows, Milwaukee; vice-president, J. B. Sullivan, Stevens Point; secretary, Frank Kaufman, Milwaukee.

Waddill Catchings, formerly president of the Central Foundry Co., New York, has been admitted as a general partner in the banking firm of Goldman, Sachs & Co., New York. Mr. Catchings has been doing considerable war work recently as assistant to the director of the Council of National Defense. He is also chairman of a committee of the Chamber of Commerce of the United States that is co-operating with the National Defense council.

Cleveland, O.—The newly-elected officers of the Master Steam and Hot-Water Fitters' Association of Cleveland, are: President, Edward Maurer, Maurer Bros. Co.; vice-president, Charles Mallett, Snyder Plumbing Co.; secretary, W. B. Vansickle; treasurer, A. E. Welker, Price-Welker Co.

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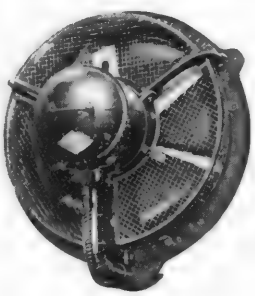
SELF-COOLED MOTOR PROPELLER FANS



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Solve Most Ventilating Problems
Correctly and Economically

"IF IT'S SELF-COOLED, IT'S AN ILG"

Ilg Electric Ventilating Co.
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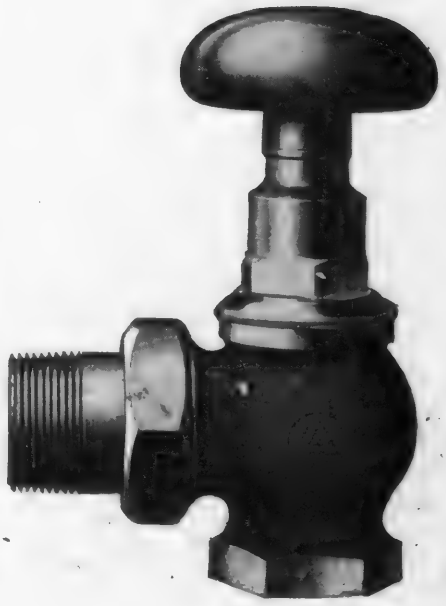
BRANCHES ALL CITIES

DETROIT PACKLESS RADIATOR VALVES



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Detroit Packless Valves are finished with the definite purpose, that they shall harmonize with the most beautiful surroundings. In addition to their unusually pleasing appearance and smooth satin finish they are permanently efficient and will not leak or need repacking.

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LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

Central Station Heating Notes

Chicago, Ill.—An increase in steam rating rates in Evanston, Waukegan, Streator and Pontiac was asked February 1 by branches of the Public Service Company of Northern Illinois. No set increase was asked, it being left to the commission to decide on a "just and reasonable rate." Adhering to its rule the commission declined to receive the application until a schedule of rates should be filed. The commission suspended until June 28 proposed rates for electric power filed by the same company and affecting 144 towns.

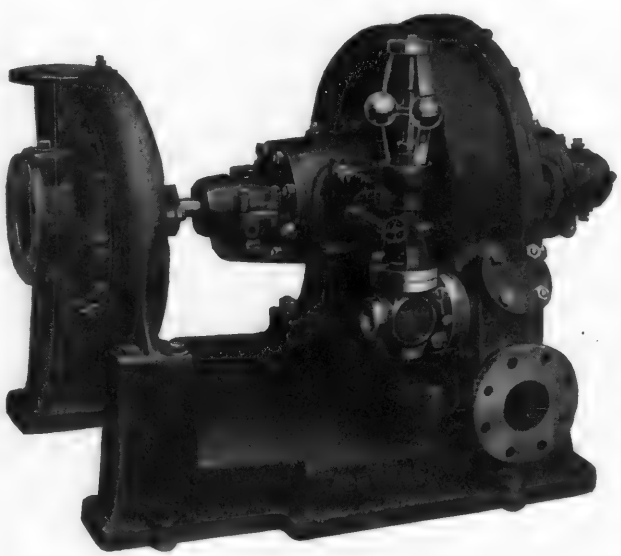
Peoria, Ill.—An order has been entered by the Public Utilities Commission authorizing the Central Illinois Lighting Company to withdraw its flat-rate steam heating rate in Peoria and to substitute a meter rate after October 1, 1918.

Chicago, Ill.—The Public Service Company of Oak Park has announced to users of the Yaryan system of heating that no higher temperature than 65° F. will be maintained in homes. In case of sickness or other emergency requiring more heat, users are advised to train electric fans on radiators, thus increasing the heat emission.

Iowa Light, Heat and Power Co., Carroll, Ia., has petitioned the city council for an increase in its hot water heating rates.

Kenosha, Wis.—Wisconsin Gas & Electric Co., through its attorney, James D. Shaw, of Milwaukee, has announced that at the expiration of the present contracts for heating in Kenosha, patrons of this service will be notified that the plant will be abandoned and that heat will not be furnished them next winter or at any future time. He stated further that the company is ready and willing to give its distributing system to the people if they want to continue operation. It is to be noted that this offer applies to the distributing system only which is said to be badly in need of rebuilding.

St. Louis, Mo.—At a hearing on the petition of the Union Electric Light & Power Company, of St. Louis, to increase its steam heating rates, it was brought out that the company has no steam heat-



Small Turbine Pump Units

In small units dependability is seldom secured without simplicity. Examine the design illustrated and note the compactness and simple features of design.

ALBERGER PUMP & CONDENSER CO.
140 CEDAR STREET, NEW YORK
Boston Pittsburgh Chicago St. Louis Philadelphia San Francisco

ing franchise and operates under no ordinance, but only on permits obtained from the Board of Public Service for laying pipes in the streets. The company serves 140 steam customers between Olive Street and Washington Avenue and Seventh and Twelfth Streets.

Logansport, Ind.—At the instance of Mayor Barnes a petition has been sent to the State fuel administrator, Evans Woollen, protesting against the proposed merger of the Logansport Municipal Electric Light plant and the plant of the Logansport Heat & Power Company. The petition states that "we are willing to conserve fuel and are willing to have the city heat plant shut down long enough to save our quota, rather than to see any merger."

Winona, Ind.—The Winona Electric Light and Water Company has filed a petition with the Indiana Public Service Commission asking that it be allowed to discontinue steam heating service after May 1, 1918, after reasonable notice or that it be allowed the following rate from February 1 to May 1, 1918: 30 cents per square foot for radiation, 25 cents per gallon capacity of boilers, radiation to be computed by standard steam heat tables, in accordance with cubic area of patrons' residences and charged for as though installed. The company's present rate is 30 cents per square foot of radiation installed and 25 cents per gallon capacity of boiler. It is stated that for the present heating season it will cost $6,414 more to produce the heating service than the company will receive for it and that, in addition, it will probably be necessary to install another boiler at an expense of $7,000. The present valuation of the plant is $10,942.

Indianapolis, Ind.—An important decision has been made by the Indiana Public Service Commission in connection with the complaints of patrons of the Merchants Heat & Light Company, who were being charged for hot water heat in their homes on the basis of the radiation the company experts estimated was necessary to heat these homes. The commission now rules that the charge should be made on the basis of the radiation actually provided.

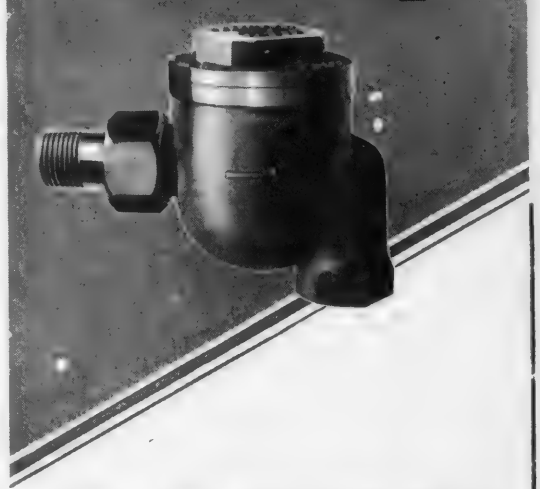
Traer, Ia.—At a meeting of patrons of the local electric light and heating company, a committee was appointed composed of C. A. Pratt, Frank Thomas and E. E. Taylor, to investigate the matter of establishing a municipally-owned heating plant in Traer.

Ottumwa, Ia.—Ordinances restoring the

A short cut to a fair profit

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

Johns-Manville Radiator Trap



Keep a dozen Johns-Manville Radiator Traps right in the bin—in the store-room—where your job-runners can pick them up quick on call. It's a good way to reach your men, the economy and advantages of the trap and it's an easy way to assure yourself your rightful profit on the next big job that comes along.

For while it's easy to figure the number of traps you'll need and the time to attach them, it's another matter to guess the time it may take to make adjustments.

And it's the cost of that time that eats up your profit on the job. Simplicity of construction makes adjustments in the Johns-Manville Radiator Trap unnecessary. For there are but three parts—the body, connecting union and rolling ball.

We will be glad to send our bulletin with its suggestions to you if you'll ask it.

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—Branches in 61 Large Cities

old rates of the Ottumwa Railway & Light Company for electric lighting, steam and power were given their first reading by the city council January 14. The reading of the ordinances came after a warm fight waged by a committee of merchants to lower the rates. The schedule for steam heating rates called for in the proposed ordinance is as follows:

	Per 1,000 lbs.
5,000 lbs.	95c
5,000 lbs.	75c
10,000 lbs.	65c
10,000 lbs.	60c
20,000 lbs.	55c
50,000 lbs.	50c
250,000 lbs.	45c

10% discount on gross amount consumed.

Marion, Ind.—The Indiana Public Service Commission has authorized the Indiana General Service Company, of Elwood, to buy the Marion Light & Heating Company. The price paid for the Marion Light & Heating Company and for the Muncie Electric Light Company was $1,000,000 each. This transaction involves the consolidation of the electric lighting business of Marion, Muncie, Hartford City and other towns under the charter of the Indiana General Service Company, one of the most important subsidiaries of the American Gas & Electric Company, of New York, of which R. E. Breed, of Marion, is president.

Springfield, Ill.—A petition for immediate relief, which is different from the usual procedure, has been filed with the State Utilities Commission by a number of the Illinois Traction System subsidiary utilities companies, asking for authority to increase their rates for street railway, gas, electric light and power and steam and hot-water heat. The commission is asked to grant an emergency increase at the present time, with a hearing to follow at the discretion of the commission. If the commission then decides that any of the proposed rates are not justified, the companies agree to make a rebate to the consumers. Separate schedules are filed in the case of each company, operating in Jacksonville, Urbana, Decatur, Clinton, Danville, Bloomington, Cairo, Galesburg, Quincy, Peoria, Ottawa and St. Louis.

Sycamore, Ill.—The Central Illinois Public Service Company has made application to the State Public Utilities Com-

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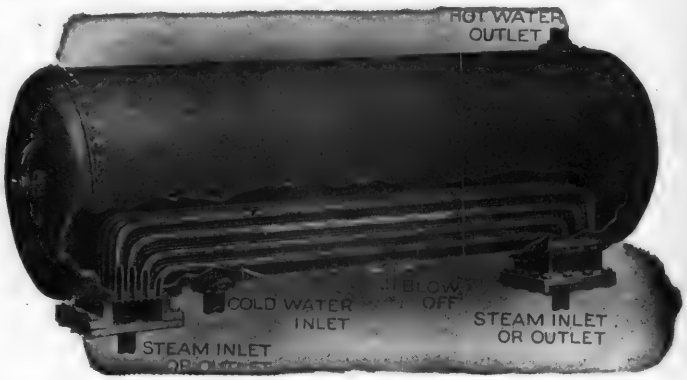
of the

PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.



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Any Combination of Storage and Heating Capacities can be Furnished. Send for Catalogue.

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In World's Finest Newspaper Plant

Two complete units of Sirocco Air Purifying Systems are serving in the new home of the Detroit News—undoubtedly the most modern newspaper plant in existence.

The top illustration at the left shows one of the two Sirocco Fan Outfits. The lower illustration shows one of the two Sirocco Air Purifying Systems.

It was our privilege to co-operate with Architect Albert Kahn, of Detroit, and the General Contractors, George A. Fuller Co., of Detroit, in the application of this Sirocco Equipment.

Our Engineering Department is glad to co-operate with Architects, Engineers and Contractors in connection with Sirocco application.

American Blower Co.

Detroit, Michigan

Branches in all Large Cities

Canadian Sirocco Co., Ltd.
Windsor, Ont.
Manufacturers for Canada

mission to discontinue operation of its heating plants in White Hall, Carrollton, Virden, Charleston and Moweaqua.

American District Steam Co., North Tonawanda, N. Y., has compiled the old and new rates for heating in various municipalities and they are published in full in the Bulletin of the National District Heating Association for January 15, 1918. These are in addition to the rates published in the October issue of the Bulletin. The new list includes Birmingham, Ala.; Sycamore, Ill.; Taylorville, Ill.; Kokomo, Ind.; Anderson, Ind.; Davenport, Ia.; Eagle Grove, Ia.; Ottumwa, Ia.; Shenandoah, Ia.; Topeka, Kan.; Baltimore, Md.; Pittsfield, Mass.; Grand Rapids, Mich.; Glenwood, Minn.; Aurora, Neb.; Chadron, Neb.; Geneva, Neb.; Scotts Bluffs, Neb.; York, Neb.; Auburn, N. Y.; Geneva, N. Y.; Newburgh, N. Y.; New York City; Penn Yan, N. Y.; Youngstown, O.; Portland, Ore.; Johnstown, Pa.; Towanda, Pa.; Wayne, Pa.; Washington, Pa.; Pawtucket, R. I.; Milwaukee, Wis. (W. P. Co.); West Bend, Wis.; Cheyenne Wyo.; Madisonville, Wyo. Also additional rates in Pittsburgh, Pa. (Allegheny County Steam Heating Company.)

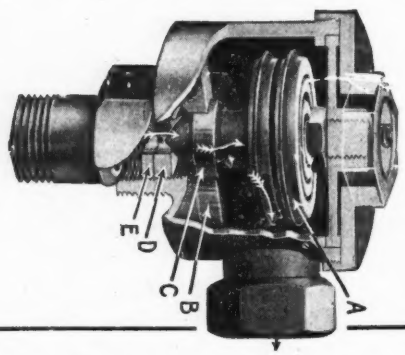
Manufacturers' Notes.

Lord & Burnham Co., Irvington, N. Y., has been appointed eastern distributor for the Newport boiler, made by the Newport Boiler Co., Chicago, Ill. The Canadian manufacturing rights and patents have been procured by Lord & Burnham Co., of Toronto and St. Catherines and the boiler will be manufactured at the company's factory in St. Catherines, Ontario. The Newport boiler is of the down-draft type and was brought out about three years ago by Charles F. Newport, a well-known Chicago heating engineer.

National Radiator Co., Johnstown, Pa., has purchased the business of the Federal Radiator Co., of Newcastle, Pa., and has increased its capital stock from $2,500,000 to $4,000,000. The National Radiator Company was organized in 1894, operating as the Fowler Radiator & Mfg. Co., at Norristown, Pa. The business grew rapidly under the guidance of John H. Waters. The plant was moved to Johnstown in 1896 and the name of National Radiator Company was adopted in 1902. The business continued to grow and in 1911 a plant, twice as large as the parent plant,

BV

RADIATOR TRAP



Liquids cannot be compressed or expanded except by cold or heat

The expansive member of this Trap is completely filled with a slow expanding fluid that is governed by temperatures only and cannot be effected by the action of a pump or pressure.

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Air Conditioning Apparatus

Air Purifying—Air Cooling
Humidifying—Dehumidifying
High and Low Temperature Drying
Industrial Ventilation
Dust Removal
Reclamation
Generator Coolers

Braemer Air Conditioning Corporation

Lafayette Bldg. PHILADELPHIA PA.

was established at Trenton, N. J. The Federal Radiator Company, which has now been absorbed by the National Radiator Company, is the outgrowth of the Novelty Iron Company, of Canton, O., organized some 25 years ago. Three years ago the Federal Radiator Company moved from Canton into its new plant at New Castle. It is stated that the New Castle plant will manufacture boilers exclusively while the Trenton and Johnstown plants will manufacture only radiators. G. C. Blackmore, of the Federal Radiator Company, is now superintendent of manufacturing of the combined companies. The main offices of the company will remain in Johnstown. The officers of the new organization are: President, John H. Waters; vice-president and treasurer, S. B.

RIC-WIL METHOD

OF

Insulating Underground Steam and Hot Water Pipes

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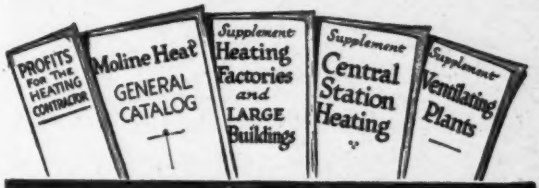
THE RIC-WIL COMPANY
CLEVELAND



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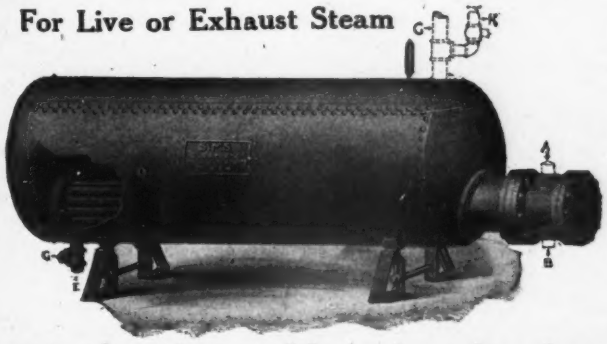
For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings Schools, etc.

For Live or Exhaust Steam



requiring large quantities of hot water. This type of heater should be used in preference to circulating generator and storage tank—or instantaneous heaters.

Special attention given to all kinds of water heating problems based on long experience in this work.

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THE SIMS CO., 18th St., Erie, Pa.

Waters; vice-president and superintendent of manufacturing, G. C. Blackmore; general manager of sales, R. E. Warden; credit manager, Charles L. Crouse; auditor, C. E. Resley.

Hudson Boiler Mfg. Co., New York, reported a successful year at its recent annual meeting. Howard T. Gates was re-elected president; B. F. Lane, secretary; and John M. Ellis, treasurer.

American Radiator Co., Chicago, Ill., has declared the regular quarterly dividend of $2.00 in cash on the common stock and an extra dividend of $4.00 in second Liberty Loan Bonds, both payable March 30. The regular quarterly dividend of 1¾% on the preferred stock was also declared, payable February 15. The company is extensively engaged in making war munitions, the Buffalo plant specializing in hand grenades and cast-iron shells. The government munitions orders are making up for a decrease in the company's regular business.

United States Radiator Corporation, Detroit, Mich., held its annual meeting of plant managers and branch managers in Detroit January 8-10.

Walworth Mfg. Co., Boston, Mass., has purchased the heating and plumbing supply business of A. Hambach Co., Seattle, Wash. This business will be conducted hereafter as the Seattle branch of the Walworth Company. Thomas Nickerson, formerly with the Seattle branch of the General Electric Co., will be manager of the new branch and will be assisted by J. M. Richmond. The business of A. Hambach Co. was established in 1889.

Carrier Engineering Corporation, New York, held a reunion of its sales engineers and salesmen at the Hotel McAlpin, New York, January 25 and 26. Conferences were conducted under the direction of President Willis H. Carrier and Vice-President and General Manager J. I. Lyle. The reunion wound up with a dinner at the Hotel McAlpin on the last day of the conference.

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Wanted.—Heating and ventilating engineer to supervise design, installation and work in advisory capacity in connection with maintenance in large rubber factory in northern Ohio. Salary commensurate with training, experience, and ability to handle men. Splendid opportunity for the right man. Address Box 40, care of Heating and Ventilating Magazine.

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